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KENNETH H. CONDIT
FRED H. COLVIN

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The Tolerance System of the Skoda Works

By DR. N. N. SAWIN
Research Engineer, Skoda Works
Pilsen, Czechoslovakia

The system, which was developed to replace the "DIN" (German) system, takes into account the influence of errors in measurement—Four grades with thirty-one classes of fit in all

FOR a long time, limit gages have been used in the various manufacturing departments of the Skoda Works in Pilsen, but in 1921 the "DIN" (*Deutsche Industrie Normen,* German Industrial Standard) tolerance system was first introduced for general use. After this system was in operation about five years, some of its shortcomings became evident, and for this reason an independent "Skoda" tolerance system was created. When fits of the DIN system were used, it was impossible to satisfy demands of interchangeability of machine parts, particularly in the case of wringing *(haftsitz)* and tight fits *(festsitz)*. The shop often got push fits (*gleitsitz*) instead of desired light drive fits. Similar complaints were made against wringing fits.

In addition, there was evidence that for diameters up to 180 mm. the tolerances were not sufficiently close, while for larger diameters they were needlessly so. This situation was particularly true for "most precise" and "precise" grades of fits, the ones most often used in our establishment. In the German system, the tolerance is proportioned to $\sqrt[3]{d}$ and hence gives an excellent geometrical form and a simple way of calculating the deviations. However, experiments made in Switzerland, Sweden, and Czechoslovakia showed that the deviations obtained in actual manufacture could not be expressed by such a simple formula: the relation between diameter and tolerance is much more complicated. In attempting to establish their own system of tolerances, the engineers of Skoda Works studied the problem along two different paths of approach: by theoretical and empirical investigation of single, elementary factors influencing the accuracy of the product, and by actual examination of the different kinds of fits produced in practice. The information from these two sources was then correlated.

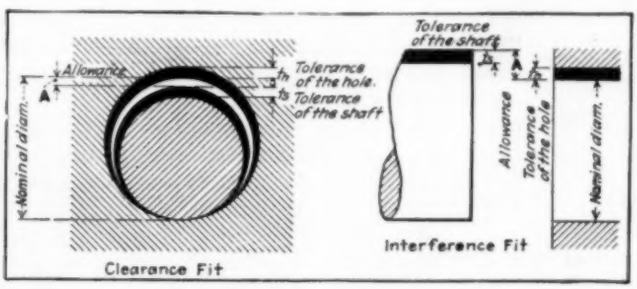

Fig. 1—Fit nomenclature

In order to avoid confusion, we will define the various terms to be used. There are two general classes of fit relating to the assembly of two machine parts: clearance fits, where the allowance is positive and interference fits, where the allowance is negative. Under actual manufacturing conditions, we seldom get the same clearance for corresponding parts. If we assume that the nominal shaft is maximum and the nominal hole minimum, the basic minimum clearance (allowance) will be denoted by A and the varying production deviations by t_h and t_s for the hole and shaft respectively, known as the tolerances. These varying production deviations of two mating parts are caused first of all by the use of limit gages. The actual dimensions of the work are within limits corresponding to the "Go" and "Not Go" dimensions of the gage. Inexactness of gages, errors in measurement and the surface condition of the piece are also contributing factors. Under these conditions, the total clearance will vary between the minimum value A and the maximum value $A + t_h + t_s$, as shown in Fig. 1. Between these limits there may be all possible combinations, but it is evident that the values of both deviations t_h and t_s must be limited so that the fundamental character of a proper fit is preserved.

While it is true in general that the tolerance of mating

parts can increase with their dimensions, as stated before, the simple relation of t being proportional to $\sqrt[3]{d}$ does not hold. Three other factors must be considered:

1—Surface of the work. 2—Shape of the work.
3—Type of measuring instruments and errors in measuring.

The surface of the work will vary as a result of machining according to whether the cut was a rough or finish one and the nature of the tool, such as lathe tool, grinding wheel, buffing wheel, reamer and others. In Fig. 2 is shown micrographs of sections of machined surfaces magnified about one hundred times. The inequalities of machined surfaces caused by size and shape of the chip and by irregularities of cutting edges of the tool will cause standard deviations as follows:

Standard machining of large piece	±0.180 mm.
Standard machining of small piece	±0.060 "
Fine machining of large piece	±0.100 "
Fine machining of small piece	±0.020 "
Fine grinding	±0.004 "
Fine grinding and polishing of hard surfaces	±0.002 "

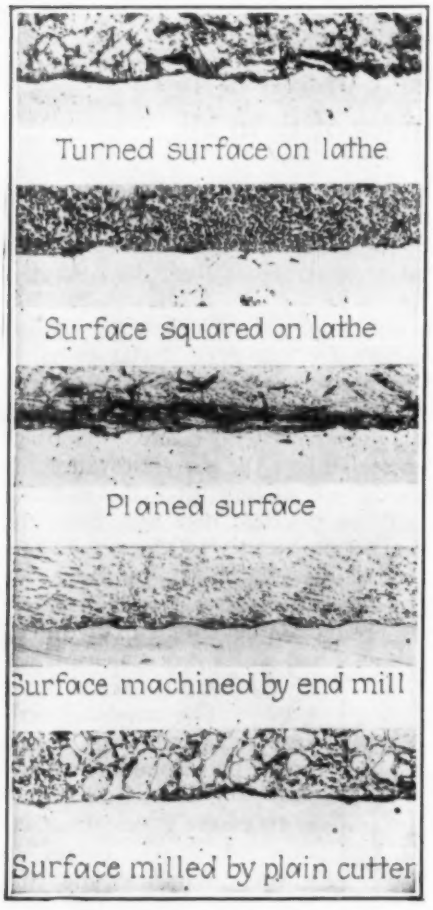
Turned surface on lathe
Surface squared on lathe
Planed surface
Surface machined by end mill
Surface milled by plain cutter

Fig. 2—Finish produced by various machining operations

The term plus refers to outside diameters; minus, to inside diameters. Errors in geometric form are caused by wearing of the tool, by imperfections of the machine tool, by elastic deformations and temperature influences while the piece is being machined, and by the properties of the stock being finished, hard spots and the like. In spite of being finished on the most precise machine and by the most experienced workman, a piece cannot be made to accurate geometric form. Cylinders will always be oval in some cross-sections and axially there will be deviations from a straight line. Experiments show that geometric errors are directly proportional to the diameter and length and that under equal conditions shafts can be produced more accurately than holes.

The geometric form of the contact surface between gage and measured part has a very important bearing upon the results of measuring. It is generally known that holes differ in diameter according to whether manufactured to standard plug gages, flat limit gages or to

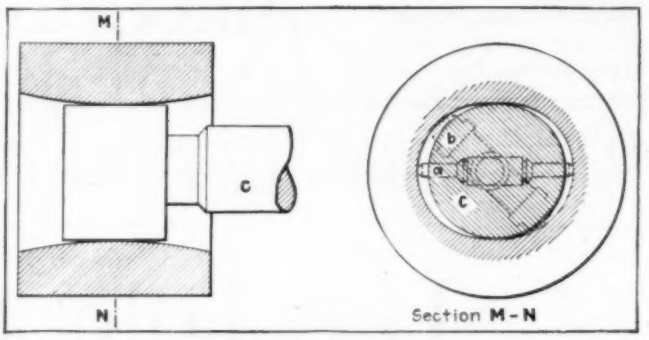

Fig. 3—Influence of type of gage upon result of measurement

ball-contact inside calipers. For the same reason there will be differences in diameter of shafts produced to ring gages or snap gages.

The measured values will be modified by different clearances between contacting surfaces of gage and of measured part and by different values of friction. With inside calipers having ball contacts, the friction will be insignificant on account of the small contact area (theoretically a one-point contact) so that the clearance can be assumed to be zero; on the other hand with cylinder (plug) gages the clearance cannot be smaller than 0.002 to 0.005 mm. (0.00008 — 0.00020 in.) as it must slip easily over the measured surface. With a snap gage the surface touches the cylinder theoretically only in a line and the minimum clearance essential in this case is only about 0.001 or 0.002 millimeters.

The deviations from geometrical form of the work also have different effects upon the several gages mentioned above. For instance: In a cylindrical bore there will be deviations from the correct geometrical shape in both a radial and an axial direction. As shown in Fig. 3, the inside gage *a* with ball contact touches the inside of the cylindrical hole in every point of cross-section and therefore may measure the maximum diameter of the hole. On the other hand, the plug gage *c* touches only part of the measured surface and may measure only the minimum diameter, and furthermore, the axis of the plug gage may not coincide with the axis of the hole. The flat gage *b* is a section of a plug gage and gives a value between the other two.

It is apparent, therefore, that the transition from one type of gage to another may result in different limits of tolerances. In order that the use of the different kind of gages may not produce unsatisfactory results it is necessary, when establishing the tolerances of work, to indicate the type of gage to be used for inspecting the product.

In addition to the above-mentioned errors in shop measurements by gages, there are some errors caused by temperature changes, by elastic deformations, and by individual errors of workman.

With a difference of temperature of 1 deg. C. between steel and a measuring gage of alloy steel, the error will be 0.0015 mm. for a length of 100 mm. and 0.0115 mm. for a length of 1,000 mm. The difference in temperature in working rooms is generally 2 to 3 deg. C., and an error caused by this difference reaches almost 0.003 for 100 millimeters.

In addition to temperature errors, each master gage has its own production error. We will assume the error of each master gage to be ±0.002 mm. When measuring with snap gages, we must also take elastic deformation into consideration. The result of measuring will depend to a great extent upon the sensitiveness and experience of

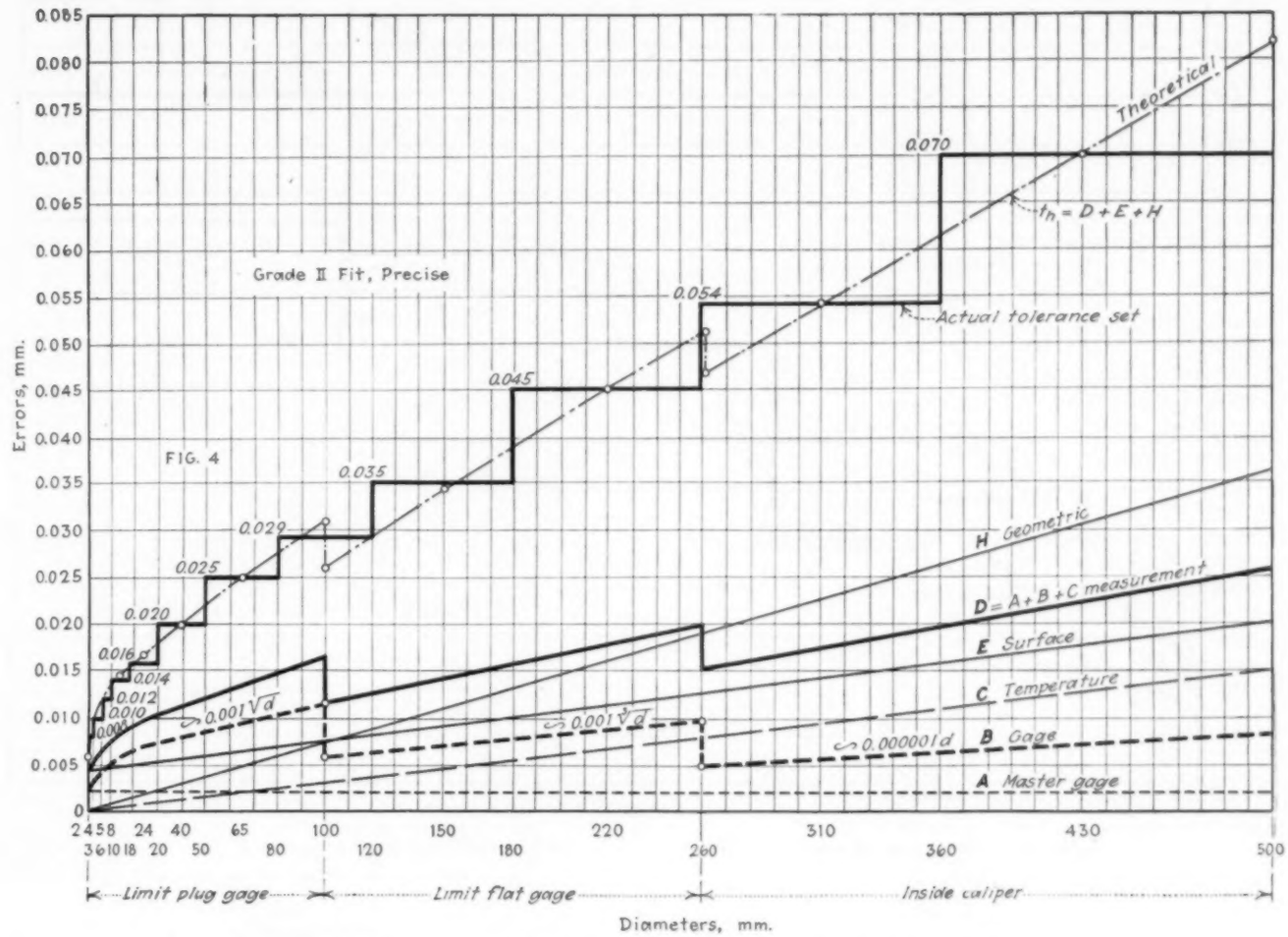

Fig. 4—Derivation of the hole tolerance t_h for Grade II fit (Precise)

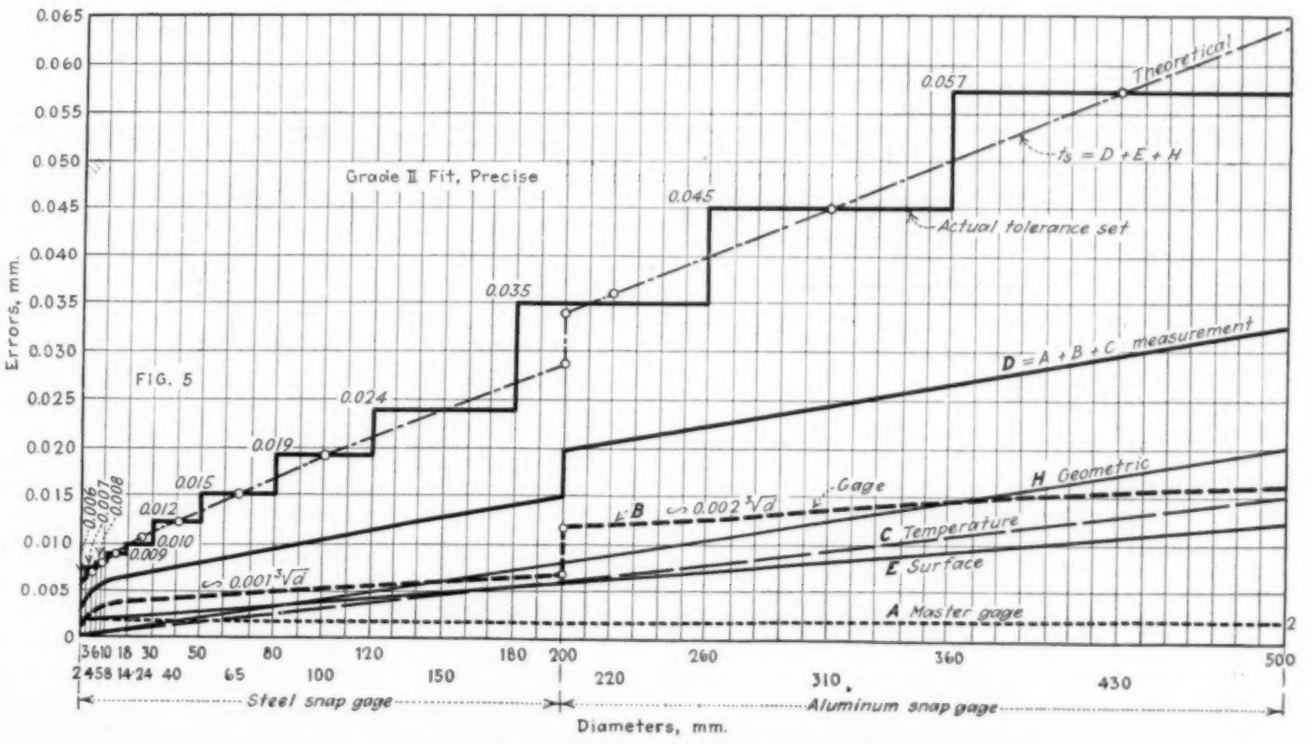

Fig. 5—Derivation of shaft tolerance t_s for Grade II fit

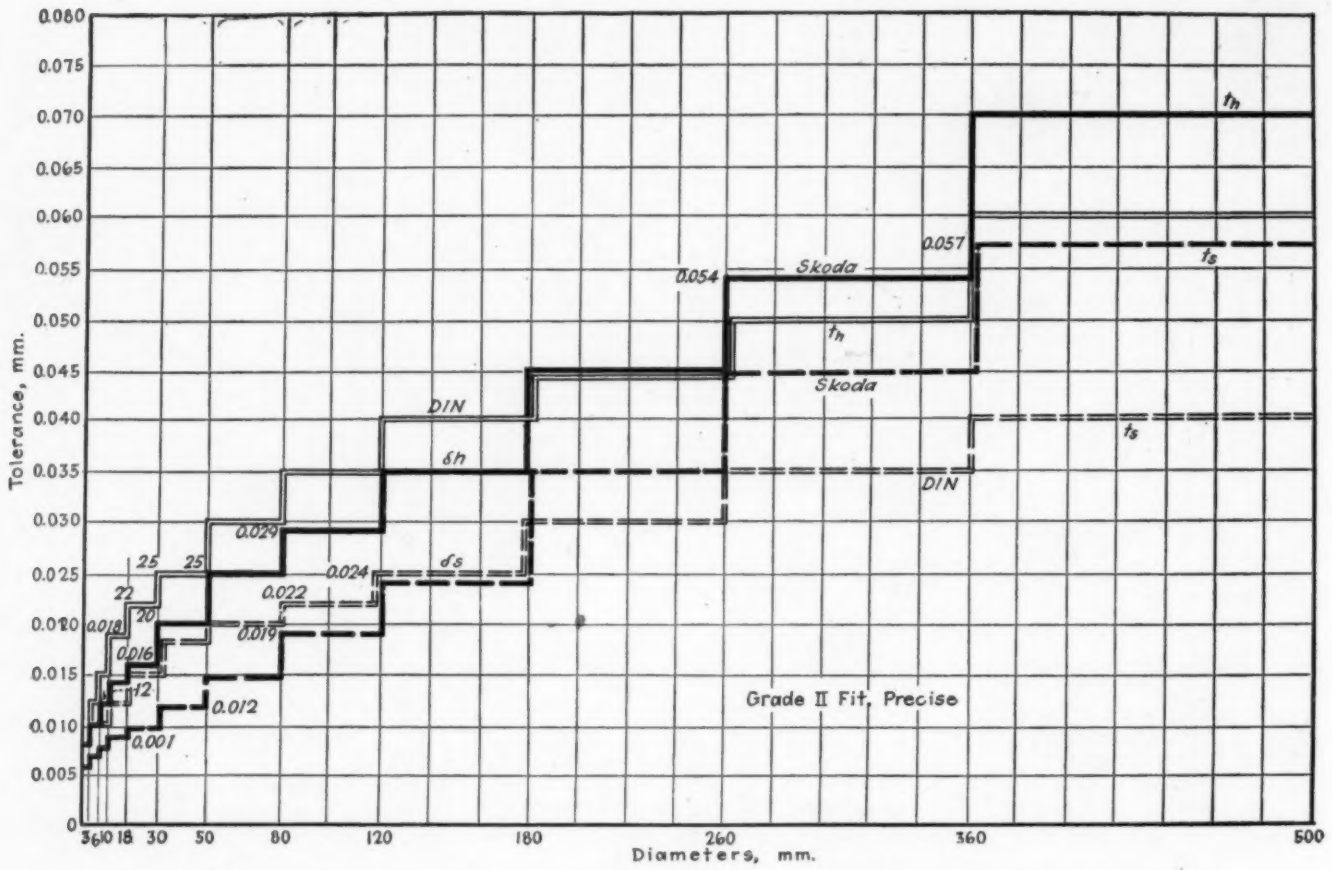

Fig. 6—Comparison of tolerances of the "DIN" and "Skoda" Systems for Grade II fit

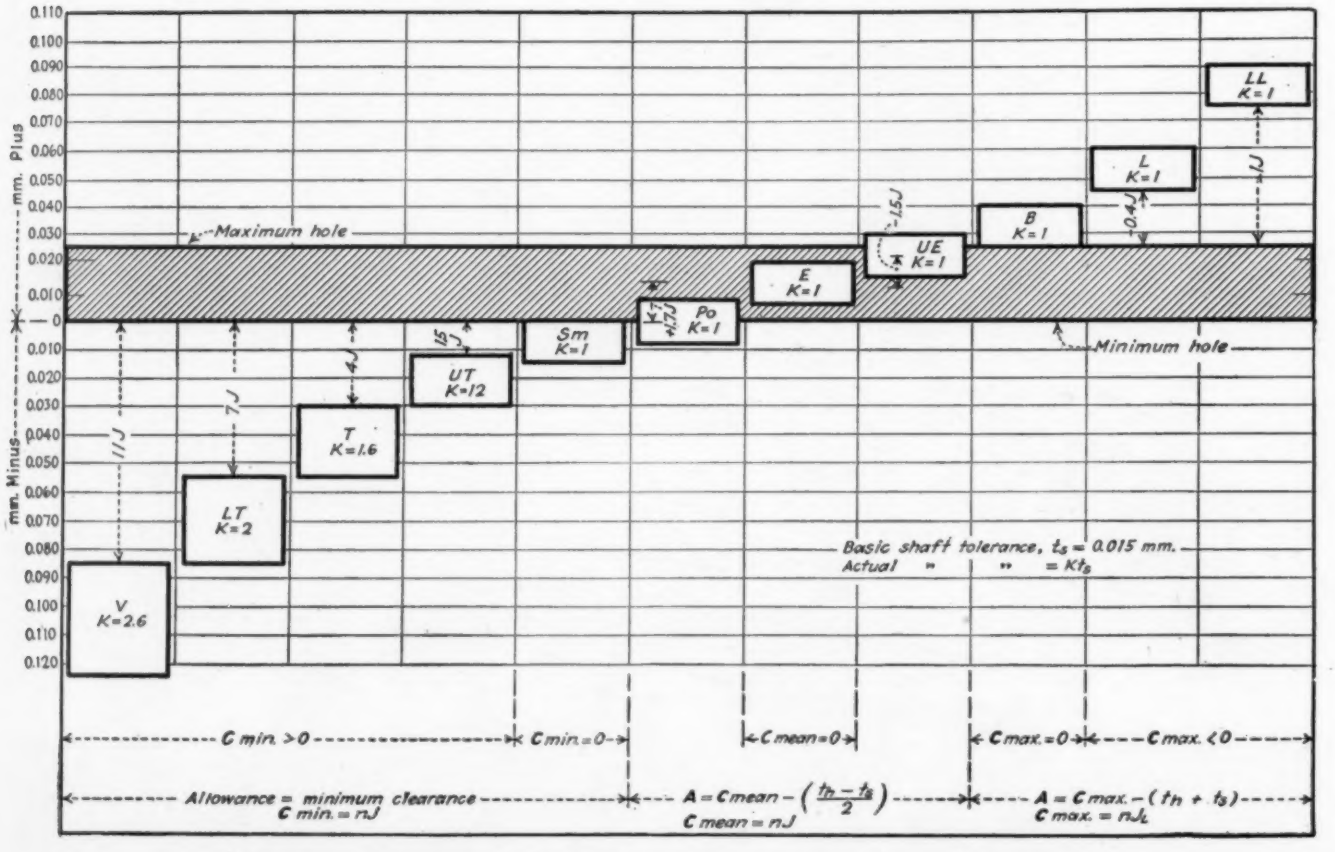

Fig. 7—Complete range of Grade II fits for basic holes 50-80 mm. in diameter

Fundamental Control Values of Skeda Works Tolerance System

Fit	Symbol	Tolerance	k	Allowance	Fitting Unit	n
Grade I—Most Precise						
Snug	j Sm	$t_s = kJ_s$	1	$A = C_{min.} = nJ$	$J = 0.001\sqrt{d}$	0
Push	j Po		1			1
Wringing	j E		1	$AnJ - \left(\frac{t_h + t_s}{2}\right)$		0
Close wringing	j UE		1			—1
Light force	j B		1	$A = nJ_L - (t_h + t_s)$	$J_L = 0.0008d$	0
Grade II—Precise						
Loose	V	$t_s = kJ_s$	2.6	$A = C_{min.} = nJ$	$J = 0.001\sqrt{d}$	11
Free	LT		2.0			7
Medium free	T		1.6			4
Close running	UT		1.2			1.5
Snug	Sm		1			0.0
Push	Po		1	$A = nJ - \left(\frac{t_h + t_s}{2}\right)$		1.7
Wringing	E		1			0
Close wringing	UE		1			—1.5
Light force	B		1	$A = nJ_L - (t_h + t_s)$	$J_L = 0.0008d$	0
Medium force	L		1			—0.4
Heavy force	LL		1			—1.0
Grade III—Medium Precise						
Loose	M V	$t_s = kJ_s$	2.6	$A = C_{min.} = nJ$	$J = 0.001\sqrt{d}$	10
Free	m LT		2.0			6
Medium free	m T		1.6			3
Close running	m UT		1.4			0.8
Snug	m Sm		1.2			0
Push	m Po		1.2	$A = nJ - \left(\frac{t_h + t_s}{2}\right)$		2.5
Wringing	m E		1.2			0
Close wringing	m UE		1.2			—2
Light force	m B		1.2	$A = nJ_L - (t_h + t_s)$	$J_L = 0.0008d$	0
Medium force	m L		1.2			—0.35
Heavy force	m LL		1.2			—0.9
Grade IV—Coarse						
Loose	v V	$t_s = kJ_s$	2	$A = C_{min.} = nJ$	$J = 0.001\sqrt{d}$	34
Free	v LT		1			17
Medium free	v T		1			8.5
Snug	v Sm		1			0

Legend:

Subscripts s and h designate shaft and hole, respectively.

t = tolerance of part (hole or shaft)
A = allowance
C = clearance
J = normal fitting unit
J_L = fitting unit for force fits
d = mean diameter of range of sizes included, i.e., $d = 65$ mm. for 50-80 mm. range.

The DIN System and Skoda Works System are diagrammatically compared in Fig. 6 for the Grade II fit (precise) and the greater accuracy for the production tolerances of Skoda Works System for diameters up to 180 mm. and less accuracy for large diameters can easily be seen. In each tolerance system the snug fit is used as a starting point, for which the *allowance* is equal to zero and the *clearance* of both mating parts is established at the expense of the tolerance of the work t_h and t_s, as Fig. 7 shows. Starting from this fit and by increasing the positive clearance between mating parts, we shall obtain a series of running fits. For these fits the absolute value of tolerance increases regularly with increasing desired stage of looseness. If we proceed from the snug fit in an opposite direction, we get a wringing fit and then a force fit. The characteristic of these fits is a negative clearance between mating parts. The principle of calculation for tolerances of all fits of Grade II is explained in Fig. 7. Clearance fits start with minimum clearance, transition fits start with middle clearance, tight and force fits start with maximum negative clearance. The relation between diameter and allowance was determined by a series of experiments and is proportional to the root of d ($J = 0.001\sqrt{d}$) for all grades of fits, except tight and force fits. The German tolerance system (DIN) originally did not have force fits. The industries demanded standards for this fit, as often, tight fit B (festsitz) would not do, and a more solid connection was necessary. Solidity of connection is determined to some extent by the force necessary for pressing in the shaft. To establish standard force fits a series of experiments was carried out with cast-iron and steel bushings, which were pressed on taper studs. The bushings and studs were carefully measured on very accurate machines and for each case forcing pressure and interference were found and recorded. It was found that minimum interference must be proportional to diameter d in order to preserve the same character of force fits for different diameters. Therefore the unit of force fit was determined according to formula: $J_L = 0.0008\ d$. The allowance of force fit is equal to $nJ_L - (t_h + t_s)$, where coefficient n is negative and is found experimentally.

For a shrink fit negative clearance is also necessary and is as a rule larger than the interference at force fit. Hence the coefficient n is about twice as large. The entire classification of fits in the four grades is given in the accompanying table, in which is also indicated the method of calculating the shaft tolerance and the resulting allowance. As can be seen from this table and Fig. 7, which is a typical application of it to a particular diameter range, the system is constructed on the unilateral principle and it is possible to manufacture with either a basic hole or a basic shaft.

the workman, upon the construction of the snap gage, and upon the surface of the measured part.

Physiological (human) errors are caused by difference in sensitiveness of eyesight and touch.

The sum total of errors caused by inequality of surface, by deviations from geometric form, and by errors of measuring (including the influence of master gage, temperature, and type of gage) is represented by the broken lines t_h and t_s in Figs. 4 and 5, respectively. The breaking points of the lines correspond with the transition from one type of gage to another.

By the same means production deviations are fixed for all grades of fit in use at Skoda Works, of which there are four, as follows:

Grade I	most precise fit	— five kinds
Grade II	precise fit	— eleven kinds
Grade III	medium precise fit	— eleven kinds
Grade IV	coarse fit	— four kinds.

The figures developed were not the results of using the same mathematical formula for small and large diameters of holes and shafts, but were originated by adding actual errors in parts regularly produced on standard machines and measured by different kinds of gages.

Book Reviews

MACHINE WORK. By Theron J. Palmateer. Two hundred two pages, 5x8 in., cloth-board cover. Published by the Stanford University Press, Stanford University, Calif. Price, single copies $2.25, in lots of 10 or more $2.

MACHINE shop work, like any other subject, can be taught better by a textbook than by the oral method. On this basis, the author has prepared the volume primarily to relieve instructors of repeating fundamental principles, as well as to make it possible for a student to work more or less independently and to increase his interest in technical reading. The majority of the material is elementary in nature.

The first part deals with fundamentals in lathe, drilling, planing, milling and grinding work. Directions are given for making such practical pieces as mandrels, gears, faceplates, and V-blocks, when only one piece is to be made.

In order to put in practice the fundamental information laid forth, the second part covers quantity production work, giving detailed instructions for the construction of a hand-power grinder. In principle, the methods shown are the same as those used in the majority of smaller manufacturing shops, describing the use of equipment most usually found in schools. At the conclusion of each section, review questions are listed. The book contains 231 illustrations of which 25 are working drawings.

MOTOR VEHICLE ENGINEERING—ENGINES. By Ethelbert Favary. Three hundred sixty-three pages, 6x9 in., cloth-board cover. Published by the McGraw-Hill Book Co., 370 Seventh Ave., New York, N. Y. Price $4.00.

IN THE revised edition of the volume, the author has included the discussion of some of the latest engine designs in consequence of the improvements made in motor vehicles. The book covers engineering practice and formulas for determining the strengths and the dimensions of various engine parts of the present-day type. Examples of standard design of all parts are included for the purpose of making the volume a handbook on the subject.

Written in a concise manner, higher mathematics have been eliminated so that those only conversant with elementary algebra, and perhaps some trigonometry, can obtain a technical training in engine design.

Changes in engine design, brought about by changed motor fuels, having an influence on the combustion of fuel mixtures causing detonation, and on the lubricating oil causing crankcase dilution, have prompted the author to add chapters dealing with fuel and detonation, and crankcase dilution, covering the arts insofar as he considers it of importance to designers and engineers. One chapter includes the influence of different fuels on engine performance outlining the cause and remedies of detonation, and the other chapter stresses factors concerning dilution, oil decoloration, and water accumulation and corrosion.

Much of the information has been brought to date by data gathered from leading manufacturers of engines. Truck-engine design is treated broadly on account of the importance of this type of vehicle.

In treating the various engine units, such as pistons, connecting rods, cylinders and crankshafts, the author illustrates design principles, giving the important characteristics that are essential to have these units perform successfully. Draftsmen, technical graduates, mechanics and others engaged in various branches of engineering, should find the book valuable.

PERSONNEL. By George R. Hulverson. A volume of the Business Administration Series edited by James O. McKinsey. Four hundred pages, 6x8½ in., cloth board covers, indexed. Published by the Ronald Press Co., New York. Price $4.50.

According to the author of this book, one of the major tasks of management is to develop constantly the intangible assets represented in the company's personnel, and in the volume he has attempted to give the executives in all departments a clear picture of the company's problems in getting the right kind of employee, and of organizing an efficient, enthusiastic personnel.

The book is divided into twenty-five chapters, first taking up the subjects of the nature and purpose of personnel work, and need for centralized control, and the analysis of the company needs and of the particular jobs. It then enters the field of the applicant and treats the subjects of building up the labor supply, sources of labor, essentials of interviewing, procedure for hiring, and determination of payments. The treatment of labor after it becomes a part of the organization is handled in the last ten chapters, with detailed discussions of the methods of rate increases, control of wage expense, transfers and promotions, employee training, personnel records, absence and vacations, and separations. It explains how to analyze both the job and the workman, and to fit the applicant into the place where he is likely to prove the greatest asset. It is a book for the plant executives as well as for the personnel manager, and should, moreover, be a useful volume to anyone wishing to understand better the personnel problems of the business.

S.A.E. HANDBOOK, September 1927. Semi-annual revised edition. Five hundred fifty pages, 4x7 in. Cloth covers. Published by the Society of Automotive Engineers, 29 West 39th St., New York, N. Y. Price to nonmembers $5. Instead of the loose leaf book formerly issued the stadard data of the S.A.E. is now published semi-annually in book form, the present volume containing more than 600 specifications, including both standards and recommended practices. Some of these are in universal use and it is estimated that they have made possible a saving of at least 15 per cent in the annual retail value of American automotive products.

YEAR BOOK OF THE MERCHANTS' ASSOCIATION OF NEW YORK. Published by the association at its headquarters 233 Broadway, New York City. The classified list of members which it contains is valued in the trades, industries and professions, both at home and abroad, as a select business directory of New York City. The total number of names, mostly those of firms and corporations, which the members list contains, is 6,667. These names are not only given in the book alphabetically, but they are also classified under the usual divisions.

The book presents the usual summary of the activities of the Merchants' Association during the year, together with lists of the officers, directors and committee members. The "Index to Classifications" gives 1,176 separate listings of commodities, trades, industries, etc.

Automotive Production

Inspecting the Sleeve Valves for Knight Engines

By Fred H. Colvin
Editor, American Machinist

Since sleeve valves are finished practically all over and the points to be gaged are many, some unusual adaptations of standard types of gages are necessary for their inspection

THE inspection of the sleeve valves for Knight engines includes a number of operations, in which dial gages are used to such an extent as to suggest similar uses in other lines of work. Before any machining is done, the sleeve castings are tested for hardness on a Rockwell machine, as shown in Fig. 1. Spots are ground where readings are desired. The sleeves are supported on the inside when the test is made. If the castings are within the prescribed tolerances for hardness, they are sent to the machine shop and, after several borings and turnings, they are finally finished by grinding in the conventional manner. There is, however, one point of difference in both the boring and the internal grinding, between the methods used here and the common practice. In both of these operations the sleeves are held in water-cooled chucks, a circulation of water being secured in order to maintain an even temperature throughout the operations. This method tends to prevent distortion of the sleeves, and aids in maintaining their cylindrical shape, both inside and out. The water-cooled chuck *A*, together with the solid ring gage *B*, used for checking the outside diameter of the sleeves, is shown in Fig. 2. This illustration also shows the type of gage *C*, used in measuring the inside diameter of the sleeves. A gage of the same type is shown on the bench in Fig. 3, the lower end being fitted with three-point contacts. Fig. 3 also shows a fixture used in inspecting the diameter of the sleeves at four points, as well as the way in which the indicators are read by the inspector. A close view of two of these gages is shown in Fig. 4, a sleeve being in position at the right. It will also be noted that the gage between the one at the left and the one at the center is attached so that its position can be adjusted. At the left is a similar fixture showing the dial indicators being set from a master plug that represents a correct sleeve. At *A* is the tapped hole for attaching the adjustably mounted gage. Both the master plug and the sleeve being checked are supported by hardened-point bearings that can be adjusted by means of the setscrews and check nuts shown at the front of the fixture. The location of the port from the end of the sleeve is very carefully checked by means of dial indicators mounted on surface-gage uprights, as can be seen in Fig. 5. The gages shown in this illustration are for inspecting the holes for the driving links, the locations of the various oil grooves on the outside of the sleeve, the outside diameter and roundness, and numerous other points. The gage *A* for

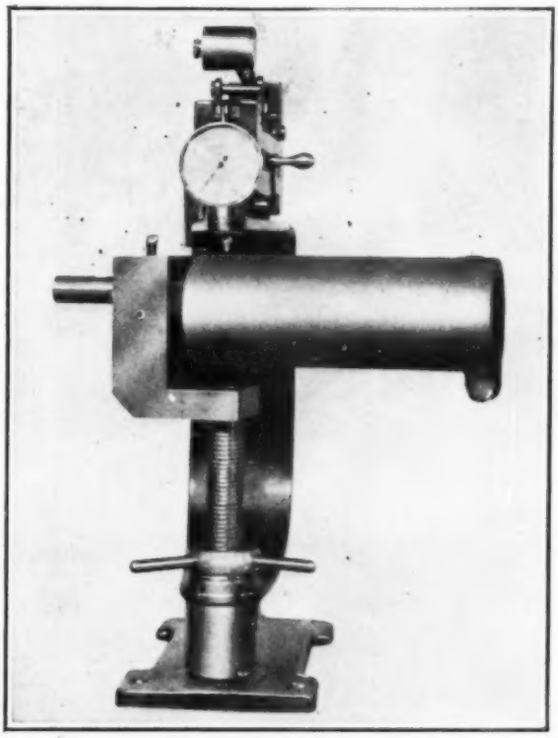

Fig. 1—Testing the hardness of a sleeve with the Rockwell testing machine. The casting is spotted on a grinding wheel at as many points as it is desired to test, and the sleeve is supported on a mandrel on the inside. If the hardness is found satisfactory, the sleeve goes to the machine shop

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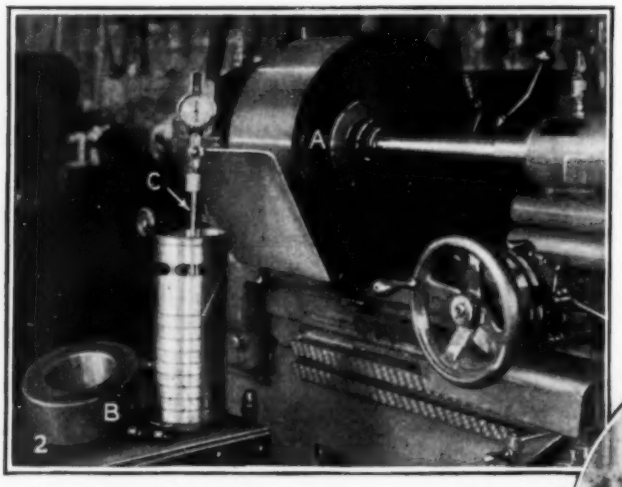
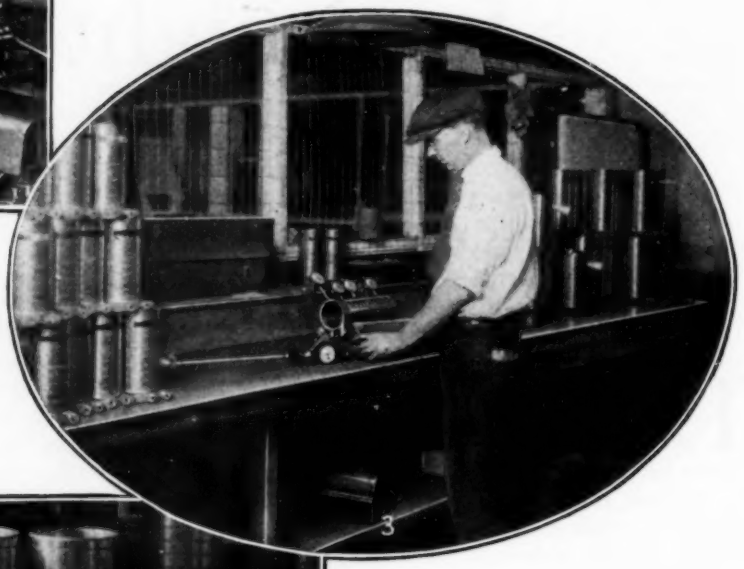


Fig. 2—Measuring inside and outside diameter of sleeve. The outside diameter is checked by the ring gage shown at the left, while a three-point gage with a dial indicator is used for determining the inside diameter. The machine shown is fitted with a water-cooled chuck

Fig. 3—Testing the roundness of the outside of the sleeve. The gage used in checking the inside diameter is also shown on the bench at the end of the inspection fixture. The fixture and the way in which the gages are applied are shown in Fig. 4 in detail



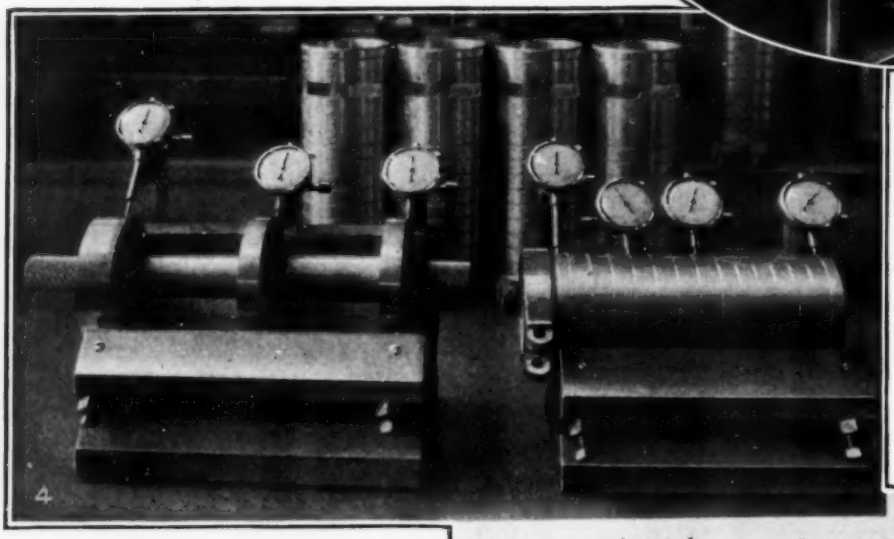
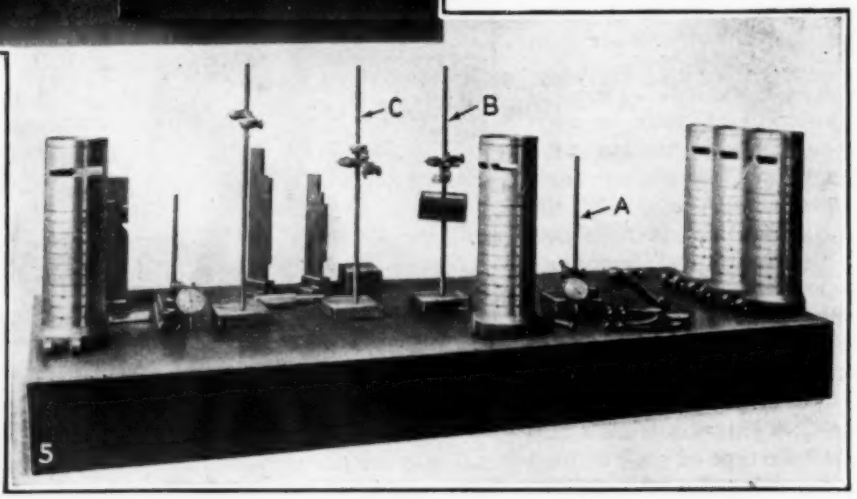


Fig. 4 — Fixtures for testing roundness of sleeve at various points. The dial gages of the fixture at the left are being set by a master plug gage and adjusted for the three positions shown. In the fixture at the right a fourth gage has been attached

Fig. 5—Surface plate and gages for checking length of sleeve, position of port openings and other dimensions. With the sleeve resting on the surface plate, the indicators on the surface gages show the height of the driving pin, the upper and lower edges of the port opening and the upper end of the sleeve. The plain high gages show the position of various rings and oil distributing grooves



Automotive Production

example, checks the distance from the surface plate to the top of the driving pin. On the other side, the surface gage *B* shows the distance between the surface plate and the port opening. The difference between the points gaged by gages *A* and *B* shows the relation of the port to the pin that actuates the sleeve. The gages *B* and *C* are set to indicate both the upper and lower edges of the port, one being used for each surface. In the gage *B*, the dial faces downward, and a mirror is used for reflecting its image to the operator. The tall surface-gage at the extreme left indicates the total length of the sleeve from the surface plate. In order to show just what is required in the way of tolerances, a drawing of the inner sleeve is given in Fig. 6. It contains all the essential dimensions. The practice of the Yellow Sleeve shop is to give both the minor and major dimensions instead of merely the tolerances. This method of dimensioning drawings has many advocates. They contend that when both the high and low limit are given, the operator is more apt to aim at the mean, or average dimension, than where the dimension is given, with a tolerance in addition. Others, however, feel that when the nominal dimension is given prominence, that is the one at which the operator aims. The most practical method is to be desired.

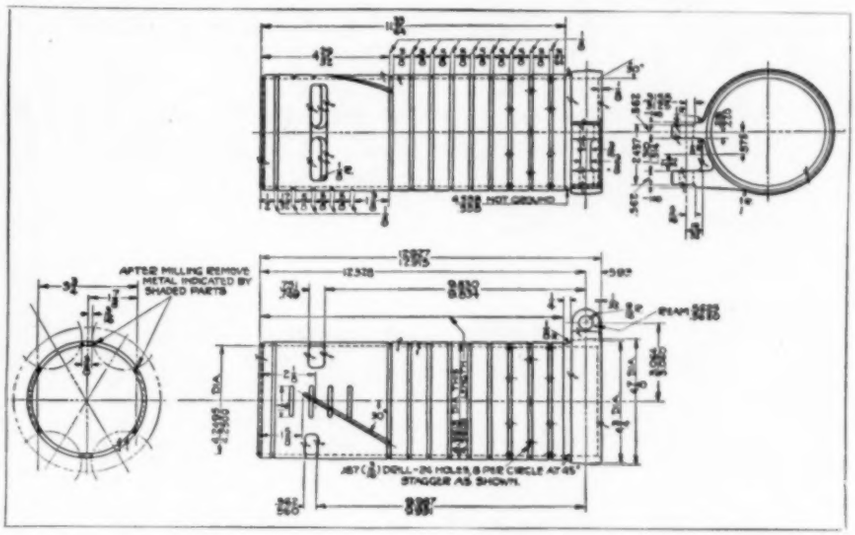


Fig. 6 — Details of the sleeve being inspected. The dimensions given show all the essential points, and also show that tolerances are indicated by giving the high and low limits of the dimension in question

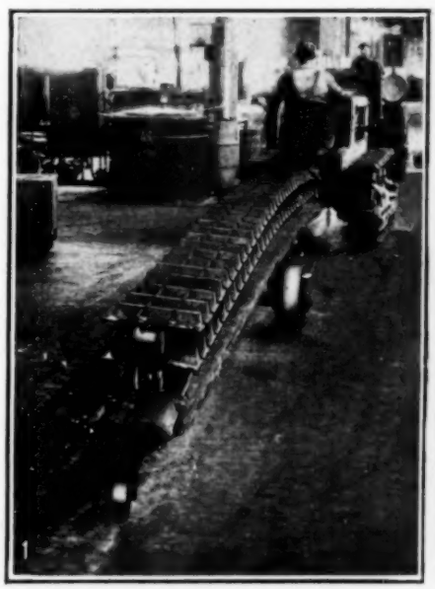
Handling Caterpillar Tracks

By Frank C. Hudson

THE track used on caterpillar tractors consists of a series of linked pads or treads, which are rather awkward to handle between the unit assembly and the floor where the tractor is being completed. The accompanying illustrations show how the Caterpillar Tractor Co., Peoria, Ill., handles the tracks.

After the track units have been assembled, they are picked up by a crane and laid on the long shop-truck as shown in Fig. 1. The truck is fastened behind a small caterpillar and hauled to the assembly department. These small caterpillar tractors are used extensively.

In picking the tracks off the truck, the long handling-bar shown in Fig. 2 is used. As shown, one track is already in place on the floor and the other one is being lowered into the proper position, so that the tractor can be set over them and the tracks assembled.



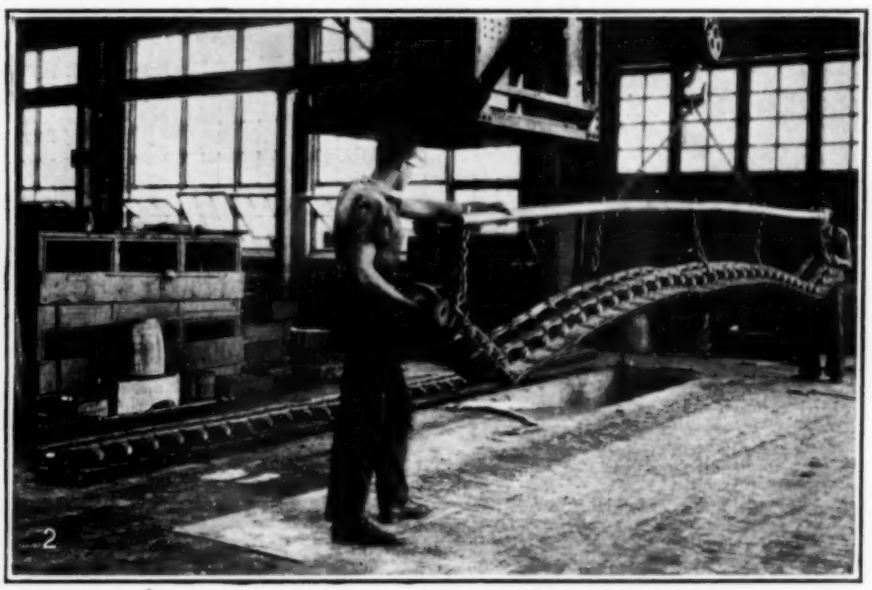


Fig. 1—Truck for handling caterpillar tracks. Fig. 2—How tracks are handled by bar and crane

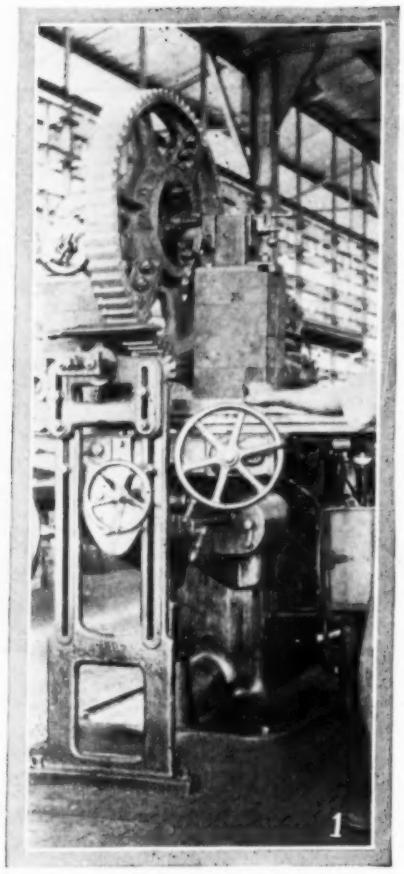


Fig. 1—A Brown & Sharpe milling machine rigged up for cutting a large split gear. The gear is mounted on a spider and is held by four small clamps. The indexing head and the tailstock are raised on the blocks shown to the desired height, and the spider carrying the gear is placed between the two centers. The indexing is done by the dividing head at the left. A C-clamp holds the rim of the gear against a substantial support in order to reduce vibration under the cut

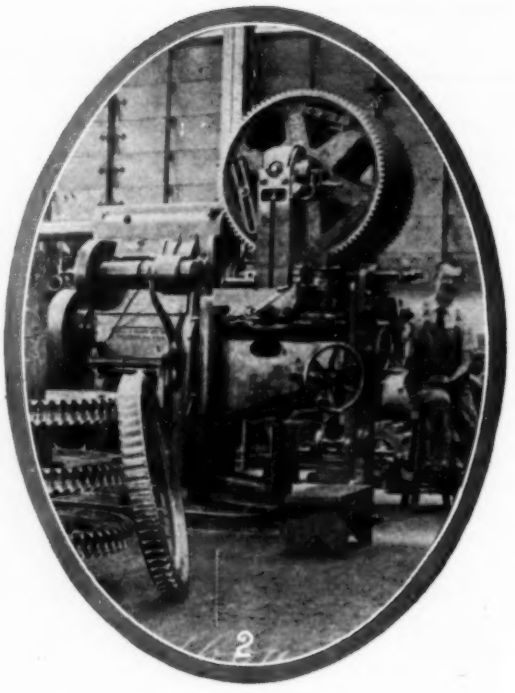


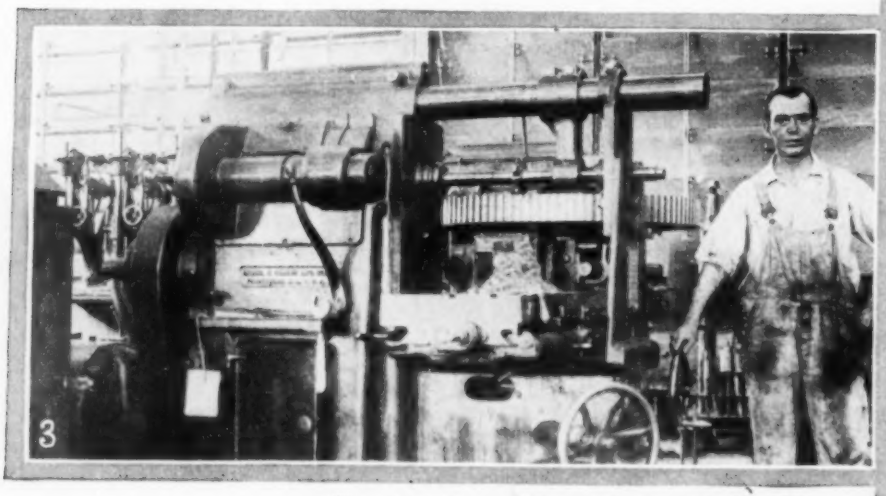
Fig. 2—Cutting four gears at once. The gears are mounted in somewhat the same way as before and are clamped together by tie bolts to add to the rigidity during the cut. Both the knee and the outer end of the cutter arbor are supported by the outer bearing. The bronze wormwheels at the left were also cut on this machine

Gear Cutting at Panama

Making milling machines handle large gears in the earlier days of the shops at Balboa, Canal Zone

Photographs by courtesy of Wm. Miltimore

Fig. 3—Cutting a gear horizontally. The indexing head is mounted on the table in a vertical position and the teeth are cut by elevating the knee so that the face of the gear blank travels past the cutter. While the load is thrown toward one end of the table, it was considered the best method for this particular job and gave satisfactory results



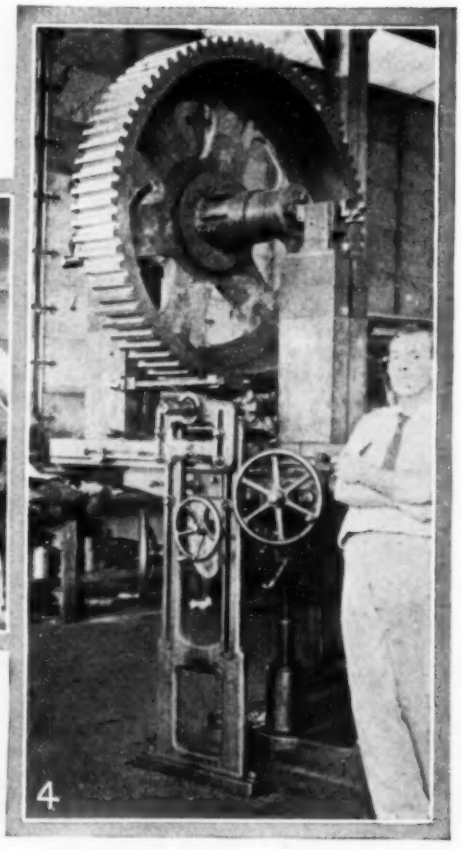


Fig. 4—A larger job cut in a vertical position. This gear was cut, mounted on its own shaft and was raised still more than the one shown in Fig. 1 by means of the higher raising blocks used under the indexing head and the tailstock. The cutter works underneath the gear as in Fig. 1. The outer end of the arbor is supported and the gear is held against vibration by the clamps shown

Management's Part in Maintaining Prosperity

By K. H. CONDIT
Editor, American Machinist

THE subject for management week, "Management's Part in Maintaining Prosperity," takes it for granted that we are enjoying a period of prosperity. Official Washington has looked us over and has announced through the President that we are prosperous. Perhaps it depends a little on the point of view. In dollar volume of business done we have set up figures that are staggeringly large but in so doing how much profit have we made?

Some of the leading industrial companies have done very well indeed. General Motors, according to its president, expects to show a profit on 1927 business of $220,000,000. General Electric profits for the first 9 months of 1927 are ahead of the same period in 1926. But something like 40 per cent of the active businesses lost money and many more made so little that they might better have put their capital in good securities, closed up shop and gone fishing. The situation does not seem exactly like unqualified prosperity. Nor is it. Two rather expressive terms have been applied to it: Selective Prosperity and Profitless Prosperity. Profitless Prosperity is unquestionably the more vivid of the two but it is hardly adequate. Profit margins are certainly narrowing but the exceptions mentioned are sufficient evidence that the term cannot be applied without discrimination.

Selective Prosperity, on the other hand, although older and somewhat more shopworn, is truly descriptive of the type of prosperity that has been our experience for many months. This prosperity has brought profits to the companies well enough managed and equipped to deserve them but it has not favored those just able to get by. Honorable traditions have not sufficed, unaided, for profitable activity.

The future is apparently not going to be very cheerful for the careless business man. It certainly is not going to do him a bit of good to wait until business gets better. That phase of the pre-war business cycle, the periodic boom, was his life-saver but it is gone, probably never to return. Colonel Ayres, the able statistician of the Cleveland Trust Company, believes that business has reached relative stability on a high plateau of activity and that steadily declining prices will make it constantly more difficult for the business man or manufacturer to get a fair profit for his efforts. He points out that many a business survived before the war only because its proprietors were able to make enough during the spurts that took place every three or four years, and during which everybody made money, to carry them through the succeeding dull periods when they either shut down altogether or ran with greatly reduced forces, leaving their men to shift for themselves and bear the brunt of hard times.

Under present conditions the plant that shuts down to wait for better times is extremely unlikely to open up again. During its absence from the markets its livelier competitors will have taken unto themselves what little business it had, and they will be very averse to parting with it. Assuming, now, that the economists are right in their belief that we are in for a long period of declining prices, and that the rather generally accepted policy of American employers to keep wages high and thus maintain the purchasing power of the country is to continue, what is management to do to extend prosperity or to improve upon it?

Five things to which management may well give careful attention if prosperity is to be maintained are: an accurate knowledge of costs, modernization of equipment, simplification and standardization, executive job analysis, and research

I want to bring before you five things to which management may well give careful attention if prosperity is to be maintained: an accurate knowledge of costs, modernization of equipment, simplification and standardization, executive job analysis, and research.

Of the five perhaps the first one to consider is a true knowledge of costs. Strange as it may seem, the manager of the average plant does not know what it actually costs to turn out one unit of his product. If this statement is not correct and the manager does know his costs, then, in certain instances at least, he is guilty of exceedingly bad practice in that he is selling at or below cost. Altruism is one of the finest of human virtues but it ceases to be a virtue when its application eliminates all profit.

Inseparably tied up with costs is the problem of depreciation allowances. Here, again, we must look on what happens either as woeful ignorance or deliberate bad management. Which term would you apply to the manager who depreciated his belting at 5 per cent per annum? A man who will do that can have no conception of his real costs and will probably be responsible for setting selling prices that are uneconomically low, and ruinous

Abstract of an address delivered at Meriden, Conn., in connection with the observance of National Management Week, Oct. 24-29.

to him and also to his competitors if they meet them.

When it comes to tax returns the government officials have developed certain rates for equipment and others for buildings based on general business practice and those rates naturally have to be used when the company prepares its tax return. But there is no reason why those rates should be employed on the books used by the company to record its real costs of doing business if they are found by experience to take insufficient account of the obsolescence factor. It does seem rather illogical to insist that a new piece of equipment pay for itself in from one to three years and then depreciate it on the books at a five or ten per cent rate.

One more thought on depreciation is this: there should be a reserve fund for the replacement of production equipment so that when the superintendent wants to retire a machine that has become uneconomical through wear or obsolescence, he can do so without going on his knees before the executive committee or the board of directors for an appropriation. Just how this reserve is to be set up is for the manager and accountant to decide. If they both recognize the need for such a fund the details will not be bothersome. The point is to get the manager into the picture rather than to have such action handled only by the financial executives.

If selling prices are based on costs determined without an allowance for such a reserve, they are almost certainly too low.

Must Modernize Equipment

Proper depreciation of production equipment leads naturally to a discussion of the vital necessity of having the best you can afford in machinery. To quote Colonel Ayres again—in his picture of the business present and future he expresses his belief that the success to which the strong organizations can look forward will be due, in large measure, to their ability to scrap obsolete equipment and produce with only the most modern machines, thus bringing their production costs to a figure lower than any that their competitors, working with less efficient equipment, could reach. The weaker company must modernize its equipment to the limit of its means. When that limit is reached and it can find no other way to bring its production costs in line with those of its stronger competitors it must either fade out of the economic picture or combine with other small organizations to build up sufficient financial power to meet the needs. I think it is safe to say that no manager can show profits if he is forced to use inadequate and obsolete equipment unless his product is protected by an ironclad patent monopoly.

And now just a word about standardization. I am not going to discuss its merits, they should be obvious, but I do want to point out a definite trend in the machinery of standardization. Formerly, standardization was rather generally conceded to be an engineering function. Today, it has swung from the engineering society to the trade association and thus enters the province of the management.

Management can do nothing more likely to maintain prosperity than to take an active interest in sane standardization and to aid in the work of promoting general adoption of existing standards of all kinds.

Job analysis has been advocated by the abler management consultants for years but there are very few instances of companies that have done much with it in executive positions. No rules can be laid down for any particular job for the reason that personalities and variable working conditions cannot be standardized. Titles mean little. I know of one plant not far from here where the chief draftsman performs every function of the chief engineer in similar plants. There is no chief engineer. Another plant has no superintendent, yet somebody must perform the functions of that key position.

Much of the inefficiency charged to management in the Waste in Industry report could be eliminated if every executive job in the plant were carefully analyzed to eliminate duplication of effort, fix responsibility and specify the duties of every official, from foreman up.

In one of the best managed of the machine tool plants, analysis of the foremen's jobs has been going on for about a year. So far as can be discovered it is the only metal working plant in which such a study has been undertaken. The results are exceedingly encouraging. Misunderstandings that delayed production are now of infrequent occurrence. Men who considered themselves "just foremen" now feel that they are department heads with important responsibilities and they are working more intelligently to accomplish the desired results.

This plant has been at the analysis of the foreman's job too short a time to have realized all the benefits that will eventually accrue. What is most needed is the experience of other plants in the same work with which to compare notes. I am convinced that if management will undertake executive job analysis seriously it will achieve success that will go far to maintain the prosperity that we all want so much.

I have but one more suggestion to offer you managers—that you take research very seriously indeed. For some companies, at least, research will be the only means by which they can hope to operate profitably. There is excess capacity in every line of manufacturing today and, as a consequence, competition that is constantly growing keener and more able.

It is surely economically unsound to let all or part of the production capacity remain idle. It is equally unsound to produce goods that cannot be sold at a profit. There remains, therefore, only the possibility of discovering or developing a new product that will not have to face the stifling competition that killed the old one.

Should Aid Research

Few companies can afford to engage in basic scientific research, but many can and should contribute to the college and scientific laboratories where such work is done. When new physical principles are discovered the applied science investigator can take them and develop them for industrial use and manufacture.

In conclusion let me state again the five items to which the attention of management is urged: accurate, current costs based on a standardized accounting system; the use of only the best procurable production equipment with adequate provision for replacement as dictated by the requirements of obsolescence and wear; careful study of internal, industry and national standardization with the purpose of adopting every item that applies; intelligent analysis of executive jobs to eliminate duplication of effort, avoid misunderstandings and fix responsibilities; research into possible new products, methods of production and materials.

If management will concentrate attention on these points and make sure that they are adequately provided for there can be little doubt that much will have been done to maintain our present prosperity and even improve it.

Machining and Measuring Gear Teeth

By Earle Buckingham
Associate Professor of Engineering Standards and Measurements
Massachusetts Institute of Technology

Automatic and continuous compensation for wheel wear a feature of the Maag gear grinder—Operation of the Pratt & Whitney grinder and others—Lapping and burnishing of gears

ALL of the generating types of gear tooth grinding machines described in the last article have been designed to finish gears of relatively small diameters and narrow faces, such as are used in the change gear transmissions of automobiles. Another design of this same general type of machine, designed for larger diameters and wider faces, is the Maag gear grinding machine illustrated in Fig. 76. This machine was developed in Switzerland, uses two grinding wheels to grind both sides of the tooth profiles at once, and has many interesting and unusual features. The grinding wheels on this machine are saucer shaped, and the grinding is done by the edge of the wheel instead of on a flat face. This edge tends to true itself as it wears. The work table moves under the wheel in the direction of the axis of the work spindle, thus causing the edges of the grinding wheels to cover planes that represent the sides of the basic rack teeth. To compensate for the wear on the grinding edges of the wheels, which is appreciably greater than on a flat faced wheel, a very effective positioning device is employed. At the upper edge of each wheel is mounted a pivoted lever carrying a diamond with a flat polished face, as shown in Fig. 77. About every six seconds of time, this pivoted lever is allowed to swing until the flat face of the diamond touches the edge of the grinding wheel. If this edge has worn, this lever swings beyond its zero position and makes an electrical contact which causes an electro-magnet to act on a lever carrying a feed pawl, thus feeding the ratchet wheel attached to a differential screw one notch. This ratchet must be moved about twenty notches to feed the grinding wheel into the work a distance of one one-thousandth of an inch. If the wheel has not worn, no contact is made, and the wheel remains in the same position. This positioning mechanism works continuously all the time while a gear is being ground, and the position of the wheel is corrected in the middle of a cut. This device has proven to be remarkably sensitive and reliable. When the wheel has worn very slightly, the contact made is not sufficient to cause the magnet to move the pawl the full distance of one notch. In addition, a push button is provided to operate this positioning device independently of the automatically - timed device, so that the position of the wheel may be set at random away from the work, and this button may be pushed successively until no further action on the ratchet takes place. When a wheel is repeatedly displaced and repositioned in this manner, this device will repeat its setting to within about two notches on the ratchet wheel. The pressure on the lever carrying the flat-faced diamond must be extremely light, otherwise the flat polished face of the diamond will be destroyed. Some diamonds seem to be harder than others. It is interesting to note, however, that some of these diamonds have been used continuously for over four years without showing under the microscope any signs of cutting or scratching by the grinding wheels.

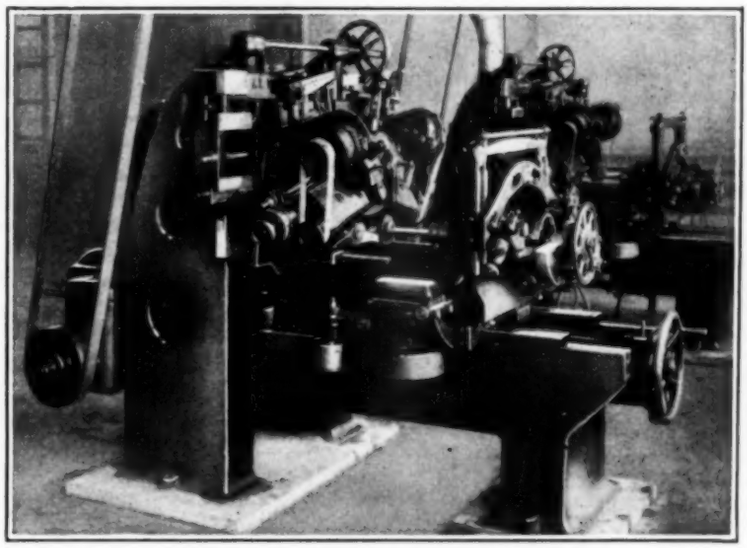


Fig. 76—Maag gear grinding machine

Another interesting feature of these machines is the pitch-disk mechanism. It will be noted in Fig. 76 that the pitch disk is nearly double the pitch diameter of the gear being ground. The work spindle is mounted on a cross-slide while the ends of the tapes are attached to a second cross-slide so that, by means of a compensating bar, the roll on this larger pitch disk may be made correct for any pitch diameter within the range of this

The thirteenth and final article of the third and last series on gears.

compensating mechanism. This feature has two advantages: First, a single pitch disk may be used to cover a considerable range of pitch diameters; and second, the pitch disk is always larger than the pitch diameter of the gear to be ground, which is of particular advantage on gears of small diameter.

These machines have a capacity up to 16 in. in pitch diameter and faces up to about 12 in. Fig. 78 shows a larger gear of wide face in position on one of these machines. A larger model of this same machine will grind gears with pitch diameters up to about 36 inches.

Another gear tooth grinding machine is shown in Fig. 79. This machine was developed by the Pratt & Whitney Co., and was described on page 535, Vol. 59, of the *American Machinist*, from which the following is abstracted.

The design of this machine was based upon the following premises: First, that the high degree of accuracy of gear tooth profiles necessary for the quiet performance of gears running at high speeds under heavy loads can be attained with the greatest certainty by the continued application of very light grinding cuts rather than by a lesser number of proportionately heavier cuts, because of the reduced tendency of the original errors to persist by reason of the inevitable "spring" of the grinding wheel, work, and work-carrying mechanism. Second, that multiple-tooth indexing would produce more accurate results under similar conditions than single-tooth indexing, because of the wider distribution and consequent reduction of errors due to wheel wear. Third, that in order to obtain a satisfactory rate of production under these conditions the grinding cuts must be made in rapid succession. To whichever part it is applied—wheel or work—the movement must be continuous, without reversal of direction or pause for indexing.

Two grinding wheels of modified saucer shape are used. These wheels are about 24 in. in diameter. The active grinding surface of these wheels is a narrow band at the edge of each wheel, and is a plane surface. Each wheel is independently mounted upon a head that may be adjusted in two directions and may also be swiveled to any desired pressure angle. These movements are for adjustment only; the wheels in action have no movement other than that of rotation.

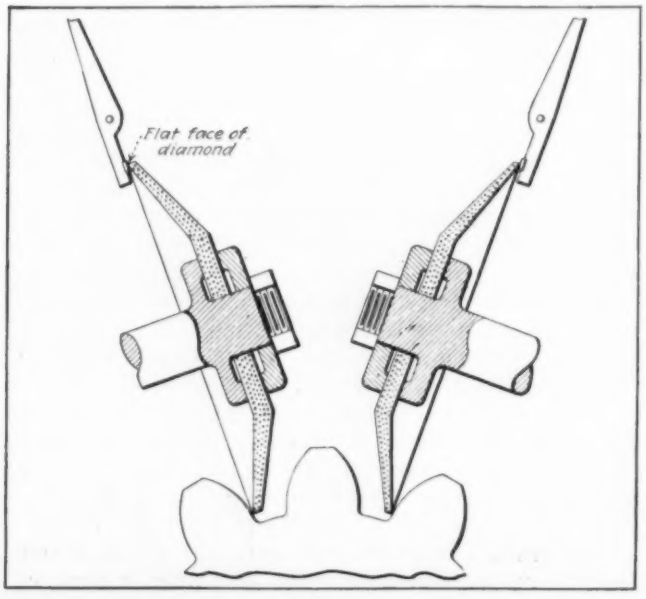


Fig. 77—Wear compensating device on the Maag grinder

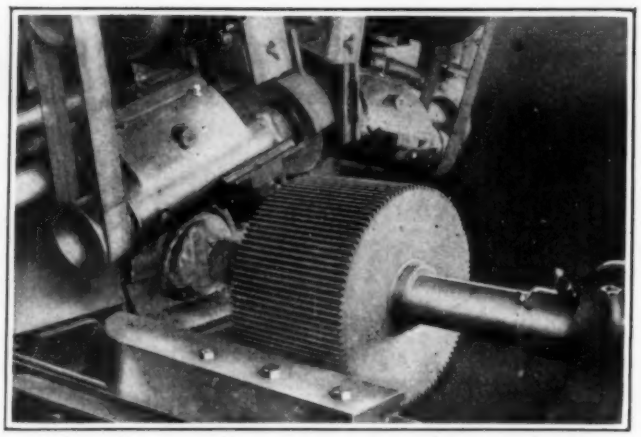


Fig. 78—Large gear of wide face in position in the Maag gear grinder

The gear to be ground is held, with its axis vertical, between centers that are carried by a frame which is so suspended from the column of the machine that while the line of its centers is rigidly confined to parallel positions and it cannot move vertically, yet is otherwise free to move in any direction. The mechanism that confines the movement of the gear to an arbitrary path is within the base of the machine below the swinging frame. In Fig. 80 a gear mounted on this swinging frame is shown.

The movement of this swinging frame and the rotation and indexing of the work spindle is controlled by a master gear mounted on the lower end of the work spindle in the swinging frame. This master gear meshes into a toothed path composed of straight rack sections inserted between the two halves of an internal gear. In addition, a smooth path of the same form operates with a smooth roll to prevent the master gear from meshing too tightly with its toothed path. Fig. 81 shows these two elements mounted in a cast-iron frame.

The grinding wheels are mounted over the rack or straightline section of these controlling paths. As the work spindle is revolved, the master gear drives the spindle of the swinging frame around this path, the gear blank engaging first with one grinding wheel as the master gear travels along the rack section on one side of the path and then with the second wheel as the master gear travels along the rack section on the opposite side of the path. This motion is continuous, and the total number of teeth in the path is always such that there is no common divisor between this number and the number of teeth in the master gear. The master gear is of the same pitch and has the same number of teeth as the gear to be ground. In this way, multiple-tooth indexing is secured. For example, if the gear has 20 teeth and the path has 29, every ninth tooth in the gear will be ground successively.

The feed is obtained by moving the frame carrying the control paths in the direction that carries the gear tooth profiles against the grinding faces of the wheels. This motion is also continuous until it reaches its final stop. The gear blank continues to travel through its orbit as many more times as necessary to work out the spring of the grinding wheels.

Another gear tooth grinding machine that is quite different in many respects from any of the preceding ones is one developed by the Garrison Gear Grinder Co. and illustrated in Fig. 82. This machine uses a cone-shaped wheel which is mounted on a ram very similar to a ram of a shaping machine. This cone-shaped wheel

travels through the tooth space, grinding both sides at once, while the gear blank is rolled back and forth under the wheel. In principle, this machine is very similar to the Sunderland and Maag gear tooth shapers which use rack-shaped cutters to generate the involute form. In operation, the ram carrying the grinding wheel reciprocates through the tooth space while the work table traverses the blanks past the grinding wheel. During each traverse of the table, the grinding wheel reciprocates in only one tooth space. The rolling motion of the gear blank is controlled by a master gear mounted at the end of the work spindle which meshes with a master rack. At the end of each table movement, the master rack is lifted out of engagement with the master gear, and the work spindle is indexed one tooth space. A further development of this machine employs a hydraulic system to control all motions of the machine except the rotation of the grinding wheel. In Fig. 83 this hydraulic machine is illustrated.

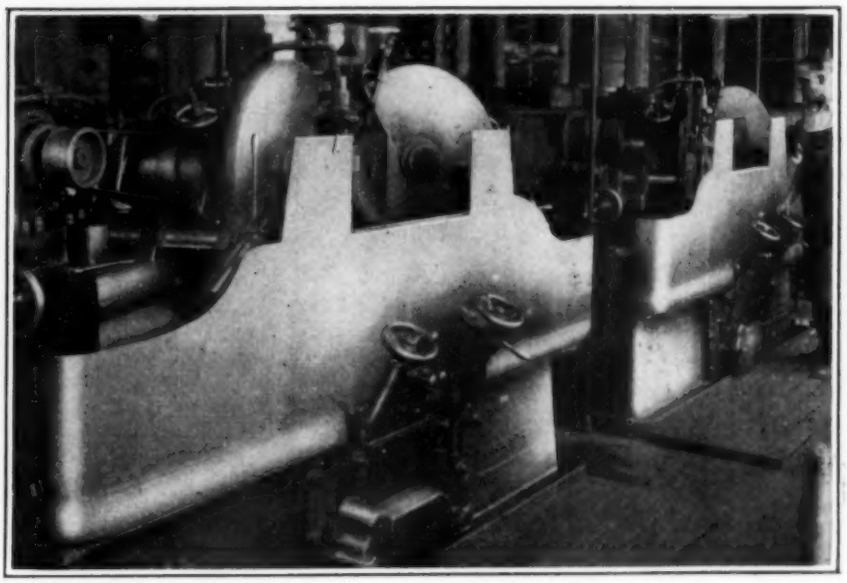


Fig. 79—Pratt & Whitney gear grinder

The lapping of gear teeth at the present time is a tool-room or laboratory process. It is possible, however, that some form of this process may be developed in the future as a satisfactory production operation.

Hardened gears are sometimes run together under load with some form of abrasive introduced with the lubricant in an effort to smooth the surfaces and correct some of the errors. This process, however, does more grinding or crushing of the abrasive than it does to polish or lap the gear tooth profiles. In order for an abrasive to work effectively, it must be rubbed along the surface to be lapped. The sliding action between meshing gear teeth is neither enough in amount nor uniform enough over the tooth profiles to obtain effective lapping action.

Another method is to mesh a hardened gear with a softer one of much wider face, and to rotate them slowly together, with abrasive, under a suitable load, and at the same time to traverse the hardened gear rapidly across the face of the wide soft gear, or lap. This process is very slow, sometimes requiring from ten to twenty hours to finish a gear, but some remarkably accurate results have been sometimes thus secured.

Another method is to mount several gears on an arbor and to mesh them with a wide cast-iron rack of basic rack form. These gears are then rolled slowly back and forth along the rack while traversing them rapidly across the face of the lap. In principle, this method is the same as the preceding one, with the substitution of a wide-faced rack for a wide-faced gear. In both of these two methods, the greatest problem is the maintenance of the laps which is necessary in order to secure consistent results. Another method, which is still in process of development, consists of the use of a lap in the form of an internal gear of the same size and form as the gears to be lapped. The gear to be lapped is reciprocated through this internal gear, and indexed at the end of each stroke, thus tending to distribute the errors uniformly about the circumference. There is a slight clearance, or backlash, between the gear and the lap, and the gear is held against one side of the lap teeth, thus requiring two operations to lap both sides of the gear teeth.

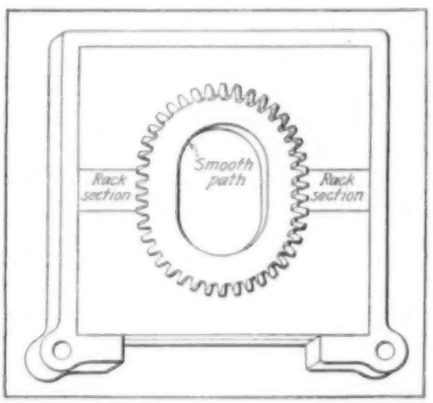


Fig. 81—Work-arbor oscillation control unit of the P & W grinder

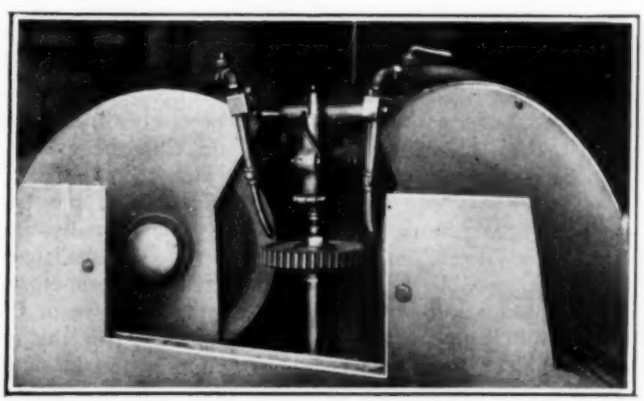
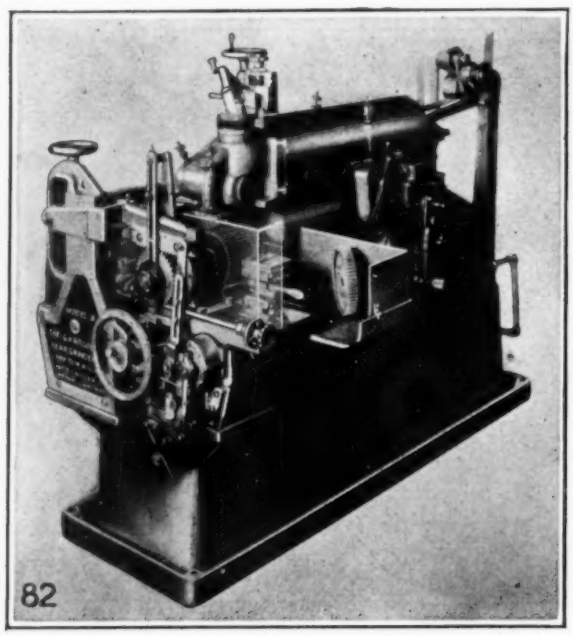


Fig. 80—Work arbor mounted in swinging frame of Pratt & Whitney grinder

In conclusion, mention should be made of the burnishing process for smoothing the tooth surfaces of unhardened gears. This process consists of running the cut gears under a heavy load with one or more hardened and preferably ground steel gears, thus cold-working the surfaces of the tooth profiles and producing a very smooth surface.

One of these processes, developed by the Pratt & Whitney Co., consists of the use of three hardened and ground steel gears or burnishers with the gear to be burnished set between them. The gear so confined squares itself on the teeth of the burnishers and requires no arbor, thus making possible a very rapid rate of production. A slight modification may be developed at the tips of the teeth of the burnished gear by making one or



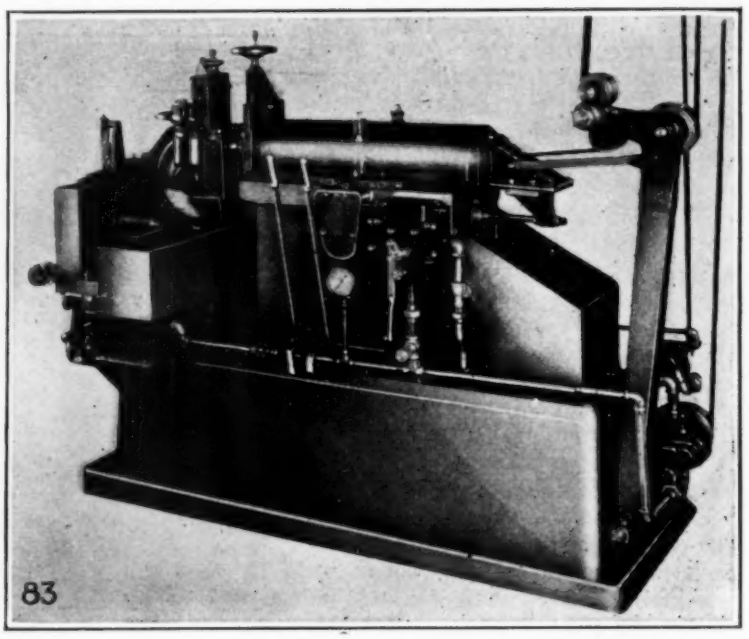


Fig. 82—Garrison gear grinder employing a cone-shaped wheel carried on a ram. Fig. 83—Hydraulically-operated Garrison gear grinder

two of the burnishers with a slightly smaller normal pitch than that of the gear to be burnished. This process proves of particular advantage when used on gears cut with pinion-shaped cutters as the sharp corners at the tips of the teeth of the hardened burnishers tend to remove any excessive fillets left in the cutting, in addition to the burnishing effect of the hardened tooth profiles of the burnishing gears.

Capital and Management Bear Brunt of Readjustment

CAPITAL and management, and not labor, are at present bearing the brunt of the suffering incident to the substitution of machinery for human effort, in strong contrast to the historical record of similar economic readjustments in the past, according to J. H. Friedel, of the National Industrial Conference Board, who recently addressed industrial leaders at Auburn, N. Y., on the subject of "Management's Part in Sustaining Prosperity." Mr. Friedel said, in part:

"Responsibility for the economic welfare of our nation rests more than ever upon industrial management. On the one hand, management is responsible to capital for the production of profits on the investment. On the other, it is responsible to labor for the maintenance of that stability of employment which is today recognized as an important factor in sustaining national prosperity. Furthermore, upon management devolves industry's obligation to the nation as a whole to meet our requirements for commodities at lowest possible cost and with the maximum efficiency in the use of labor and materials.

"The development of our present industrial-economic structure is the outcome of changes almost revolutionary in some respects, and cutting deep into our entire social as well as economic life. The outstanding characteristic factor in these changing conditions has been the extensive substitution of the machine for manual labor. Mechanization and improved organization have so increased the productivity of industry in the United States since the beginning of the century that on an average 67 workers in 1925 produced as much as 100 men turned out at the beginning of 1900. The total manufacturing production of the United States has increased 65 per cent from 1914 to 1925 alone, or 3½ times as fast as the population.

"This period of intensive mechanization, in which more and more of both the heavy and the skilled functions of manual labor were turned over to the machine to do, has often and properly been referred to as a second 'industrial revolution.' Whereas, however, previous similar modifications of economic life have usually been accompanied with at least temporary suffering which mostly fell upon the wage earning class, it is significant that in this, the American industrial revolution, there was comparatively little suffering, and such dislocation and readjustment as had to be undergone to make room for progress, paradoxical as it may seem, has fallen rather upon the owners and the management of industry instead of on the wage earners. For while capital has been dislocated and equipment frequently had to be scrapped, and executives with old ideas had to make room for executives with new ideas, the wage earners during this recent period of industrial readjustment on the whole have derived almost immediate gain in the form of higher wages as well as, since 1921, in declining price levels, thus doubly benefiting from this machine age, and quite in contrast to the earlier industrial revolution when the introduction of machinery threw many workers out of employment during the transition period. The worker's average weekly earnings today, measured by what it costs him to live, are more than a third greater than they were just before the war, but it is precisely during this period, that is during the past decade, that the greatest amount of mechanization has taken place in industry.

"Europe has of late been intensively studying our methods of mechanization, is adapting them rapidly, and in some instances, improving upon them. We shall have to be prepared to meet an ever increasing competition from foreign industries. Upon management rests the responsibility to sustain prosperity not only for the individual firm, but, by far-sighted planning and at times by wise restraint as well as by fair play in competition to safeguard sustained general prosperity."

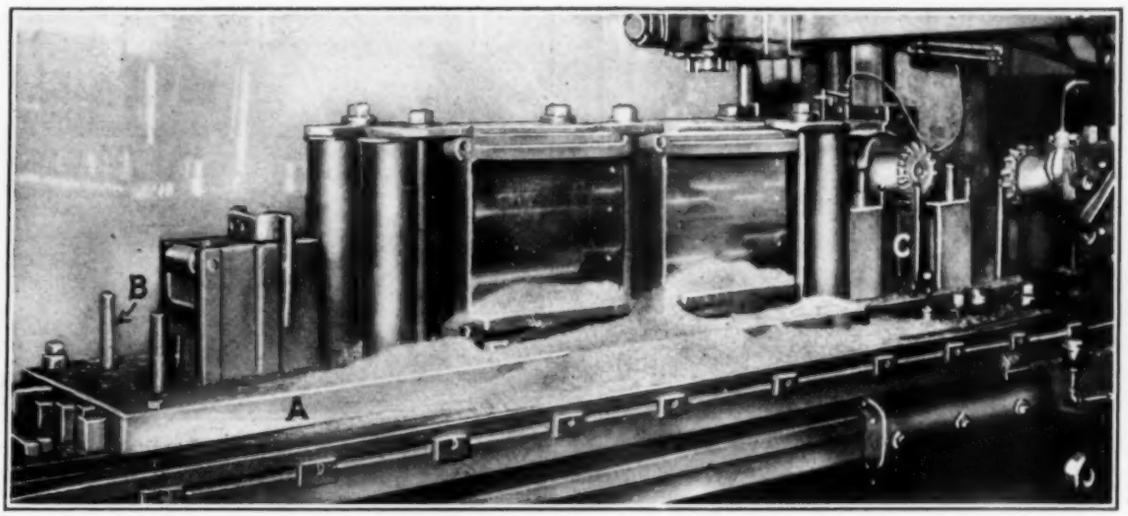


Fig. 1—Milling the sides of locomotive driving boxes

Improved Rail Shop Methods

By FRED H. COLVIN
Editor, American Machinist

MILLING, as a method of machining parts of locomotives, has grown more or less spasmodically in railway shops. For, while it is almost universally used on connecting- and side-rod work, its use on driving boxes, shoes and wedges, and other work of a similar character is by no means common practice. Various reasons are given for not using the milling method. These range from complaints as to the purchase of material that ruins the milling cutters, to the initial cost of the milling machines required and the equipment of milling cutters that are necessary. Some railroad shops, however, use milling quite extensively, a few instances of this kind being illustrated herewith. One large railroad, whose officials prefer that it remain nameless, uses milling extensively in much of its work. Two interesting examples are illustrated herewith. Fig. 1 shows a pair of steel driving boxes being milled by the two side heads on an Ingersoll machine. As will be seen from the diameter of the milling cutters, two passes are necessary to machine the entire width of the bearing surface of the driving boxes. It will also be noted that, instead of clamping the driving boxes directly to the table of the milling machine, an auxiliary bed or table is provided at *A*. This table is equipped with studs as at *B* and *C*, and also has a number of tapped holes at various points so that either studs or bolts of various lengths can be inserted at convenient points to accommodate the work to be milled. In this manner, it is an easy matter to clamp various kinds of work to this auxiliary table and obviate the necessity for special fixtures in each case. A somewhat unusual milling machine job is shown in Fig. 2 where the shoes of a crosshead are both being milled at one setting. The crosshead to be milled is mounted on a mandrel *A*, both ends being tapered to fit the crosshead. The mandrel is supported in the special double

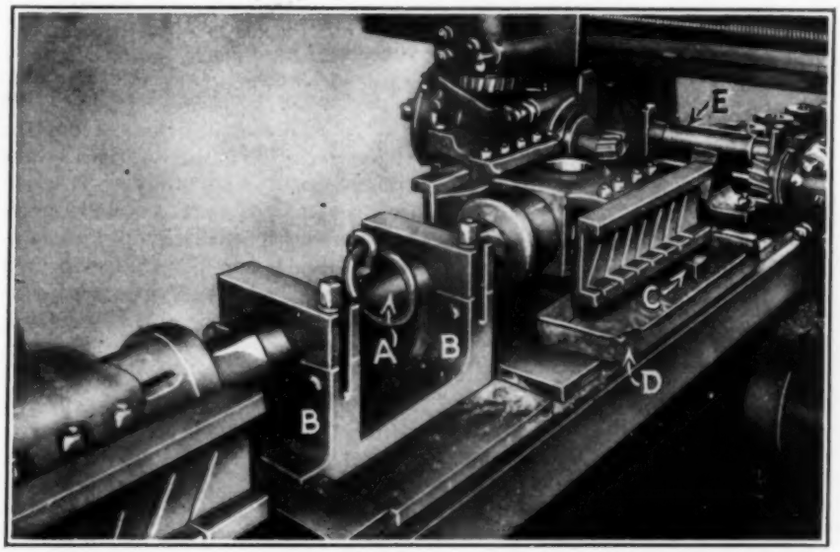


Fig. 2—Milling both crosshead shoes at one operation. A double fixture is provided so that two crossheads can be machined at the same time. A gage for setting cutters to standard distances is also provided

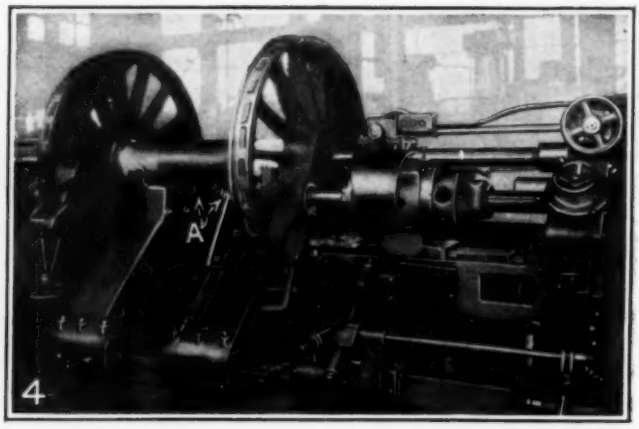


Fig. 3—Drilling valve motion link and link hanger. The fixture is built on a base of channel steel and permits the work to be easily put in or taken out. The method secures correct location of the links and saves considerable time. Fig. 4—Boring crankpin holes on quartering machine. This machine clamps the wheels at the rim and also provides an outboard bearing for both boring bars. It is electrically driven and has a convenient push button control

Vee-block *B*, having easily adjustable clamps. The mandrel is also provided with a lifting ring so that the work can be easily handled by a small crane. The ends of the cross-head are supported by suitable blocks as at *C*. These blocks rest inside the pan *D*, so as to catch the babbitt metal and allow it to be easily separated from the others. The holding mandrel is double ended so that it is an easy matter to mill two crossheads at one setting. As soon as the cutter finishes one crosshead, the table is speeded up by means of the rapid traverse until the cutter approaches the second crosshead. At *E* is a gage for setting the milling cutters. This, as will be seen, consists of a steel bar welded to a cast-iron upright by which it is positioned on the milling-machine table. This gage enables the operator to set his milling cutters and be assured that the crosshead shoes will be properly milled. It is, of course, necessary to exercise care that the cutter gage is set both square and central with the Vee-block, so as to insure that both the crosshead shoes will be milled equi-distant from the center line of the piston rod. The use of these standards in setting the cutters for milling the crossheads, indicates that this railroad maintains a standard distance between crosshead guides at each shopping of the engine.

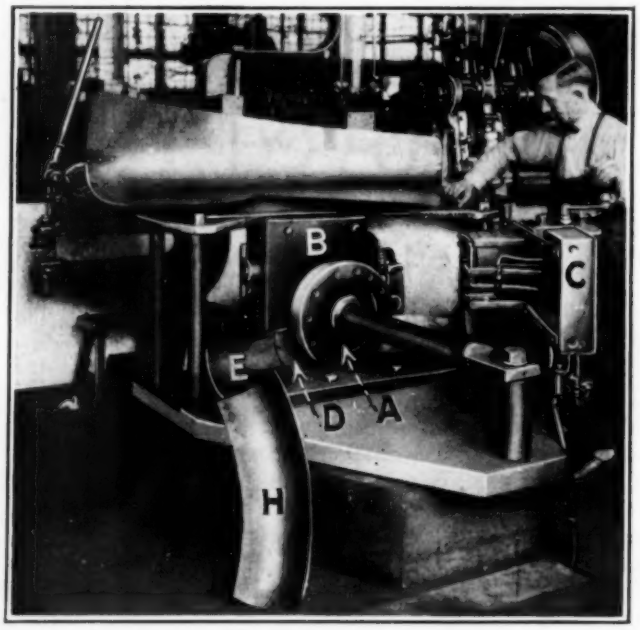


Fig. 6—Special machine for rolling curved sheets. The roller is pivoted at the desired radius and is forced over the sheet by a motor through the double reduction worm gearing shown. The piece at the side shows the work

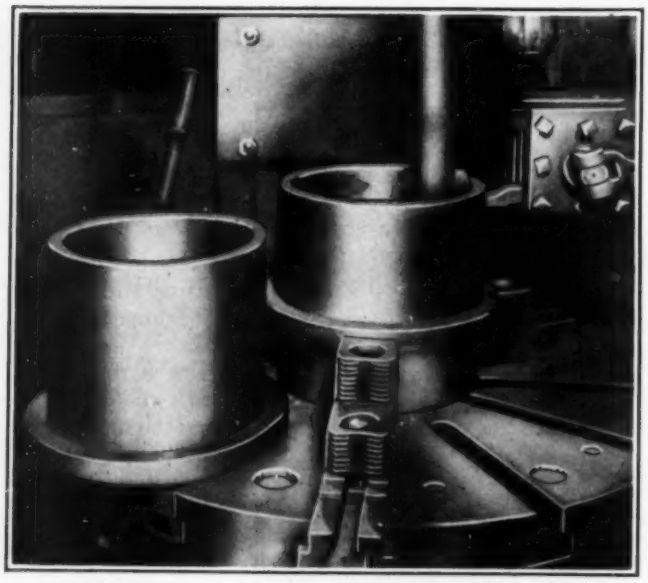


Fig. 5—Boring and turning floating bushings. These bushings are being used to a considerable extent in the back end of the main rod so that their economical production has become a railroad shop problem. By chucking them as shown, the outer tools can both turn the outside and face the flange. At the same time the hole can be bored by the tool in the turret

The guides are also milled in this shop and are afterwards finished on a Diamond surface grinder. Any refinishing that may be necessary is also done on the grinder.

The method of drilling the links and link hangers is shown in Fig. 3. The trunnions of the link hangers are held in the fixture, as at *A*, with the link itself held between them, so that all three parts can be drilled at the same time. The arm of the link hanger is also positioned by the rod *B*. The whole fixture is built up on a channel base to which are fastened the clamping arm *C* and the locating block *D*. The whole drilling fixture is supported on two I-beams and by blocks at the ends. The direct thrust of the drill is taken by the stud *E*.

A new quartering machine has been installed as in Fig. 4, it being one of the latest designs and has been equipped with some special features. The axle is supported in V-blocks that have fenders in the outer ends, and the wheels are held against movement by clamps at the rims. Outboard bearings are provided for the boring bars as shown at *A*. The machine is entirely motor driven with push button control.

Floating bushings are being used more and more in the back ends of the main rods, a method of boring and turning these simultaneously being shown in Fig. 5. The bushing is so set as to permit its being turned and the shoulder faced at the one setting. The bore is completed at the same time by the tool shown inside. Two lengths of bushings are shown indicating the extent to which floating bushings are being used.

An apparatus for forming curved sheets was seen in the sheet-metal shop and is shown in Fig. 6. It consists of a heavy plate base with the steel roller *A* pivoted as shown. The outer end of the shaft carrying the roller is supported in the motor unit *B* which carries a double wormgear reduction. The motor is controlled by the controller box *C* and forces the roller through its arc. In this way the sheet *D* is forced to conform to the shape of the roller and of the die or form *E* in which it rolls. A completed piece is shown at *H*. This has proved to be a very satisfactory machine that saves considerable time in producing curved pieces.

Hardening and Testing Steel by the "Cloudburst" Method

IN A PAPER* presented to the Iron & Steel Institute, it was shown that articles of hard steel such as gears and cams of motor cars are superhardened by the severe abrasion that occurs in service. The investigation of superhardening caused by wear suggested the inquiry whether articles of hard steel could be superhardened beforehand, as a means of resisting wear. The result was the "Cloudburst" invention, of which the following account was given by the inventor, Edward G. Herbert.

Physicists tell us that we are immersed in an atmosphere consisting of molecules flying about with high velocity and constantly colliding with each other and with us. Imagine instead an atmosphere whose molecules consist of small, hard, steel balls, flying about with high velocity and colliding with each other and with any object immersed in it. An article placed in such an atmosphere will be subjected to a rapid succession of blows, and if a certain relationship exists between its hardness and the atmospheric pressure—that is, the momentum of the balls—its surface will be compressed without being sensibly indented.

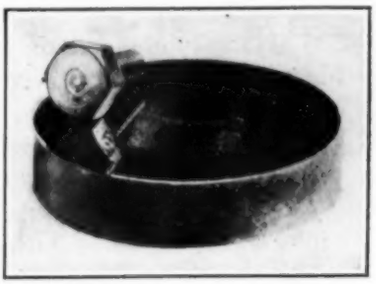
The article, if of hard steel, will become incased in a thin superhardened layer. If the velocity of the balls be now slightly increased, the hard layer will resist indentation, but will be increased in hardness and in thickness. By gradually increasing the velocity of the balls, a superhardened layer can be produced, intensely hard on the surface and gradually decreasing in hardness throughout its thickness, which may be about 2 mm. As there is no abrupt change of hardness, there is no tendency for the layer to flake or scale off.

The actual hardness that can be thus produced depends upon the superhardening capacity of the steel, and the ball velocity required to produce this hardness can be determined by experience.

Just as there is a relationship between the original hardness of the steel and the initial ball velocity that will compress the surface without indenting it, so also there is a relationship between the "maximum induced hardness" of the steel (as measured with the Pendulum Hardness Tester) and the final ball velocity that is sufficient to produce maximum hardness but is insufficient to indent the superhardened surface. Any further increase of velocity would merely roughen the surface without increasing its hardness, and the whole superhardening process must therefore take place between these two limiting velocities. The process can of course be applied to produce a work-hardened layer on any metal by adjusting the initial and final ball velocities to its original hardness and its maximum induced hardness.

The atmosphere of steel balls was invented and investigated as a means of superhardening. The investigation has revealed, however, another effect of equal importance.

The initial ball velocity is so adjusted to the hardness of the work that it is just insufficient to indent the surface. It follows that if any part of the work is soft, its surface will be indented and roughened. If, for example, a quantity of hardened steel articles are placed in a ball atmosphere of correct pressure, it will be found on removing them that any soft articles or any soft spots can be easily distinguished.



Soft part of steel indicated by "Cloudburst" bombardment tester

We have here a new process, whereby large quantities of hardened articles can be tested for hardness, all at once, and all over, and without marking them, except on the soft spots. Where quantities are sufficient to warrant it, the work can be carried through the testing chamber on a conveyor, and when it emerges the soft pieces can be picked out like rotten cherries from a tray of ripe fruit. By choosing a suitable velocity, all surfaces, hard and soft may be indented, and the hardness at any point measured by the size of the indentations.

In the illustration is a piece of mild steel, case hardened and superhardened. The letter *H* had been painted with protective compound before carburizing, and was decidedly softer than the surrounding surface. The Cloudburst roughened the softer surfaces and rendered it easily visible. The reflection of the steel screw shows the mirror-like superhardened surface.

For producing the steel ball atmosphere two methods have been employed. In one, the balls are caused to fall into the chamber from a height, which can be varied, and continuous circulation of balls is maintained by means of a conveyor. In the other method, the balls roll down an incline and are struck in an upward direction by the vanes of a rotor whose speed can be varied. After entering the rubber-lined chamber in which the work is placed, the spent balls again roll down the incline, thus maintaining a continuous circulation.

*"The Workhardening of Steel by Abrasion," Edward G. Herbert, presented at Glasgow, Scotland, September, 1927.

THE · FOREMAN'S · ROUND · TABLE

Making Time Studies

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"WHAT was the trouble this morning, Ed? Seemed to be all worked up about something when I went by."

"Guess I was a bit peeved, Al. Sorry I showed it so plainly."

"Well, spill it, Ed.—what was it all about?"

"Hadn't intended to say anything about it till I had a chance to talk it over with Williams. It was that new chap in the planning department who got me riled up a bit."

"What was the trouble?"

"Well, he wanted to time-study one of the jobs on the big turret lathe. Nothing wrong with that of course. But he tried the gumshoe game of busying himself in a corner so he thought Bill Jackson couldn't see him. Of course Bill knew it p.d.q., because every man near him suddenly had an errand over Bill's way and tipped him off."

"But you don't boss the time-study men, Ed!"

"True, Al, but I don't let any of 'em come pussy-footing in my department getting the boys all riled up for fear there's a cut or some other calamity coming."

"But he'll go to headquarters and put in a kick."

"Guess not, Al, but I can't help it if he does. Williams won't stand for it after he gets back. That's one thing I like about Williams, Ed, he's a square shooter. But I've seen too much of that secret time-study stuff, Al, and it gets my goat."

"So have I, Ed, and it doesn't get you anywhere. It makes the men mad if you do manage to keep it a secret. And generally you don't. It's a lot better to come out in the open—to have everything thoroughly understood, and get the men to work with you. They'll play fair with you if you do with them. But when a kid, who doesn't know much about the work anyhow, tries to put it over on them, they'll play hob with any time-study he tries to make."

"I'm sure glad you agree with me on this, Al. Any good man in the shop can fool almost any time-study man if he tries. It takes a man who has been in the shop pretty recently to appreciate all the new ways of cutting machining time. And some of the boys are cleverer than gyp garage men when it comes to making things go wrong with the machine—when it's being studied. The best way is to make the men see you are open and above board—and they'll usually play the same game with you."

Is Al right about making time-studies in the open?
Are secret time-studies ever justified?
What relation does the foreman bear to the time-study man?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Insurance and Savings in the Shop

THE live employer of today does not depend on wages alone for the goodwill of the workers. He finds some way to express a closer personal interest in them, usually in something that interests and benefits the family as well. Entertainments are excellent promoters of good fellowship, but with repetition lose their effect, and if given outright at the company's expense, are hardly ever fully appreciated. Bonuses and prizes are splendid stimulations of interest, but rarely add to the permanent comfort or security of dependents. Such extras are usually but fair-weather favors enjoyed by the healthy, the youthful, and those not in distress. Outright gifts of money in times of reverse are seldom accepted in the spirit that prompts the doner, and are gratuities that cannot be depended upon. Collection of funds from fellow employees is both a strain on the victims' funds and an annoyance to the employer. To a conscientious man, the fact that his family may some day be obliged to receive such charity is abhorrent. There is a way to help worthy employees at only nominal cost—the group insurance. A well organized welfare program may even be more expensive, and far less acceptable. Group insurance makes possible protection both to the physically unfit and the financially unable. It offers the employer an opportunity to reward for long and faithful service, and to the employee a further incentive to stick to his post. It secures the family of the employee against want at his death, and the happiness in the thought is reflected in his labors in a way that no gift or favor from the employer can bestow. Since it requires continual employment in order to derive the benefits, it also helps to keep the workman on his job, and thus assures his family an uninterrupted income. —P. D. PHILLIPS, *Chief Engineer.*

IT IS good policy on the part of the plant management to stimulate among its employees the saving habit, and this is particularly true in the case of those individuals who are none too careful with their money. No set rules, of course, can be applied. There will, for instance, be such employees who are known by the department head for their thriftiness. These employees have their own preferred saving practices, and the plant, in instituting insurance and money saving plans, will not always win co-operation from these men, whose saving methods are adequate and successful. On the other hand, there are always those employees who would like to form some suitable money-saving habit, yet who are uncertain, and let the matter hang. These men would gladly welcome suggestions and co-operation.

A good procedure would be for one of the management to discuss this proposition with the different foremen, who in turn can broach the subject to their men, perhaps at a meeting, not overlooking individual discussion. Thus, personal views can be obtained direct, and the management will be enabled to determine its popularity and probable success. —FRANK V. FAULHABER.

I BELIEVE that the foreman of the auto parts shop performed a noble service to his apprentices and mechanics when he suggested that they start a thrift account and make a weekly deposit of 25 cents. Once this idea of thrift is embedded in the minds of the men, it will soon pay dividends to both the men and the company. It will create a desire to increase the amount, and thereby bring about a more contented mind, with a resultant increase of production and a higher calibre of work. It is impossible for any man to give his best service to his employer when he is burdened with financial worries. I think that the company did the right thing by organizing thrift on a business basis. The men will feel that their money is safe with this arrangement, and it will encourage them to keep up with the payments. The combined endowment and group insurance plan is a very good idea. This will tend to bring the employer and employee into closer relationship, create a better feeling toward each other, ease the mind of the employee when unforeseen difficulties arise, and result in making the daily work a pleasure, and it will increase and better the production. Thrift and the procurement of insurance in the days of maximum earning capacity will provide means for carrying a man and his family through the period of lowered earning capacity, accident, sickness or death. —G. SICKLES.

THE · NEXT · TOPIC

Foremen as Inspectors

ADVANCE QUESTIONS

Should foremen act as inspectors?

Or is their sole duty to get out production?

How should the foreman and inspector work together?

Receiving the New Man in the Shop

THERE are two sides to this question. The new man, upon whom "tabs" are kept the first day, may probably return the compliment, and before the day ends, the foreman may "get the sack" as far as the workman is concerned. The man, especially if he is a good one, may decide that his new foreman is not up to expectations, and he may ask for his pay. Such a foreman would certainly deserve the "sack," as he evidently lacks the fundamental prerequisite to foremanship—the knowledge of human nature. Another point is that the best workmen are often sensitive. The foreman should remember that first impressions last the longest, and that consideration begets consideration.

Self-confidence is necessary to good work. And nothing weakens a man's confidence in his own powers more than to find that he is not trusted. Instead of giving the new man the most difficult job he can find, he should select for him a fairly simple one, for whatever may be the man's ability, he cannot be expected to be at his best in a strange environment.

—F. C. EDWARDS, *England*.

THE average man when beginning a new job is generally nervous. He knows that he is being sized up by the foreman and the other men who are wondering what kind of a mechanic he is. He wants to make good, and sometimes in his desire to do so he is apt to make some error or create a bad impression. If the foreman will meet him kindly, and help him get acquainted with the other men, a great deal of the nervousness will disappear. In that case he doesn't feel like an intruder when he asks the man next to him where certain things are to be found, nor does he have any misgivings about finding out what the policies of the company are. In short, he becomes a valuable man to the company much sooner than if he was left to shift for himself.

The foreman's responsibility has just begun when he receives and starts the man. He should exercise a certain amount of supervision, not so much, however, that he will give the man the impression that he is watching him all the time. He should stop and speak to him occasionally, making suggestions, and engaging him in conversation to try to gain his confidence. There is nothing a man dislikes so much as to have the boss standing over him when he is working.

—P. H. PEARSON.

How Handle the Man Who Can't Listen?

THE man who can't listen takes himself so seriously that the minute his brain begins to want to function his tongue starts up, no matter how discourteous it may be or how irrelevant his words to the topic in hand. Unfortunately he usually lives in a narrow little world of his own, and he is often entirely unconscious of the fact that he is all out of step.

Due to this characteristic, men of the "can't listen" type really do not hear the instructions that are given them at times, and yet feel resentful if the consequent errors are laid at their door. These errors are usually ones of omission, and may be avoided before the damage is serious by calling on the man suddenly when he is off on his tangent to repeat what he has been told so far. If he can't then is the time to lay down the law.

—HARRY A. GOSLAR.

Getting Ideas from New Men

AL SHOWED good judgment in asking the new man how he'd do that pump base job. The fact that the new man was previously employed by a firm doing similar work made his opinion worth having. Al was certainly not thin skinned, and had no reason to be. He must have been "onto his job," and had no fear of losing prestige because of being open to suggestions.

The cases where it does not work out for the foreman are usually those cases where the foreman holds his position by putting up a big front and using the force of his position to back him up. This condition is much too common for the good of industry in general. A foreman who can feel as Al does on the subject is likely to be superior to his men in all respects so as to have their good will and assistance. If a man of Ed's calibre tried the same stunt it would be taken by the men as an admission of incompetency, and he would suffer accordingly.

—JOHN J. KAUFFMAN.

IN MANY factories there is no suggestion system by which an employee may contribute an idea to the management, but the employees often make suggestions to their superiors. Too often, men have become dissatisfied and have ceased to offer suggestions because the management let it be known that machine operators had better attend to their own work. Or else suggestions are promptly rejected at the moment, only to be accepted later, after any need for acknowledging the source had passed. The wise foreman will listen patiently to suggestions.

—ERNEST SIMONSEN.

Solving the Vacation Problem

VACATIONS for the shop are just as practical as for the office, provided that they are arranged with forethought. If a man were ill, his services would have to be dispensed with for a short time, so why not for a vacation? The expense of a vacation would be outweighed by the savings made through the time bonus system, and if properly arranged it would not affect the shop routine.

—W. E. WARNER, *England*.

THAT sounds like a mighty good system, Ed, for stopping the lateness nuisance by giving the boys a half day's vacation for being on time for a month. It never did any good to take a few cents away from a man just because the trolley got stuck one morning—makes him feel that the company wants to squeeze all it can out of him. But how about the man who happens to come late the first day of the month under your system? He knows he has lost his vacation bonus and doesn't give a darn about coming on time the rest of the month. Wouldn't it be better to give the bonus for any four weeks running, or even for any three weeks?

—CHARLES S. HAZARD.

IN THIS town there are two large factories, each employing about 2,000 people, and in both factories the office help and foremen get two weeks vacation with full pay. The difference, however, is that in one factory every workman, after a year's service, gets a week's vacation with full pay, while in the other factory no man in the shop gets payment for as much as half an hour unless he works it.

Production may suffer when an operator is away for a week on a vacation, but, in my opinion, the appreciation by the workers for the favor of a week's vacation with full pay works wonders, and is an incentive for the rest of the gang or team to keep the production up. As one of the other correspondents noted, "Friendly relations between all concerned is the foundation," and it is my opinion, from observation, that the management of the one plant is wise in allowing every employee a week's vacation with pay.

—J. T. TOWLSON, *England*.

Ideas from Practical Men

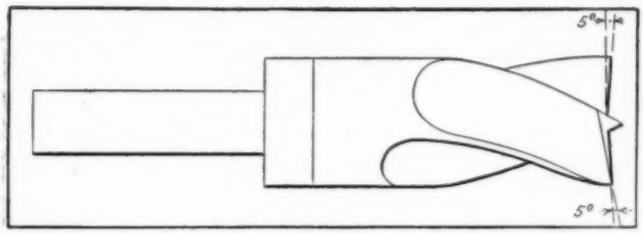
The department, "Ideas from Practical Men," is devoted to the exchange of infomation on methods useful to the machinery industries. Its scope includes all divisions of the metal-woking industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit

Drill for Leather and Fibre

By George R. Miller

In drilling leather and fiber it is impossible to make a clean, smooth hole by using either a wood bit or a twist drill ground to the usual angle.

For this class of work I use a worn or broken drill, ground as indicated in the sketch. The drill was held



A drill that will cut a smooth hole in leather or fiber

in a chuck in the lathe, using a toolpost grinder and a small wheel to grind the lips flat and to form the sharp point. The clearance on the lips was ground by hand on a bench grinder, care being taken not to injure the point.

Set-Ups for Turning and Milling Profiles

By Arthur F. Parker

The tool-room of Belding & Mull, Philipsburg, Pa., manufacturers of telescopic rifle sights, frequently has to make formed milling cutters which must be an exact copy of from three to four inches of the breech end of a rifle barrel. The illustrations show some of the necessary set-ups on the lathe and milling machine by which these cutters are made.

In turning the cutter blank to the required form, the rifle barrel is strapped to the lathe bed and the bore of the barrel is set in a line parallel with the work centers. A dial indicator is fastened to the compound rest as in Fig. 1, by some convenient means, and is adjusted to bring its point of contact on the horizontal center line of the rifle barrel. The point of the cutting tool, shaped somewhat like the contact point of the indicator, is set at a position on the cutter blank corresponding to the place on the rifle barrel where the indicator bears.

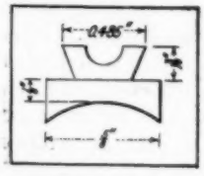


Fig. 2—End view of a barrel block

A fairly high speed and fine feed is used. The cutting tool travels toward the tailstock, so that it will feed away from the larger diameter

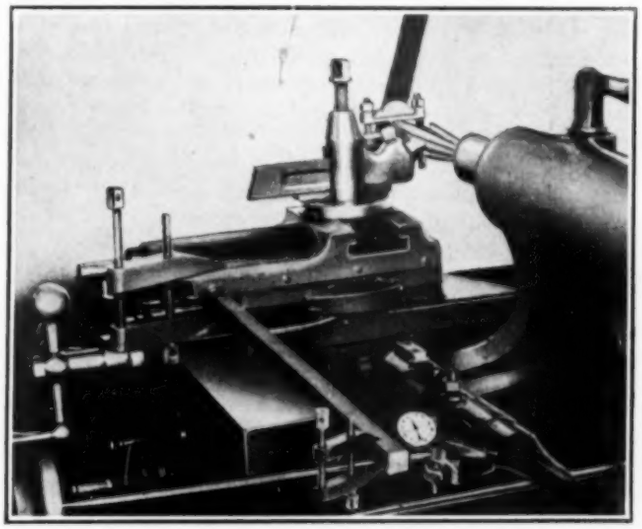


Fig. 1—Set-up for turning the cutter blank

at all times. A finish is obtained that requires but little polishing to make a smooth job. One or two light cuts over the piece after the roughing cuts are made, is all that is necessary, and after a few trials it is surprising how easily the contour of the barrel can be followed by keeping the pointer of the dial indicator at zero during the operation.

Occasionally a barrel of special shape comes along to be mounted with a telescope, for which there is no formed cutter at hand to mill the barrel block. A piece

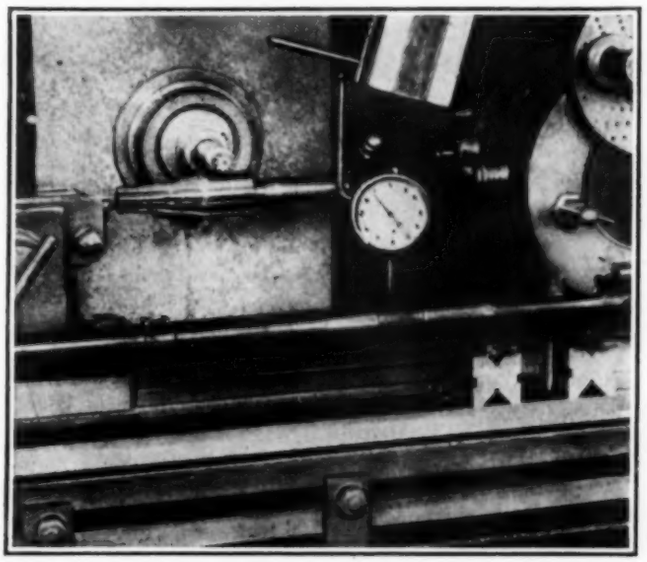


Fig. 3—Milling flutes in the cutter blank

of steel of the correct diameter is chucked in the lathe and roughed out inside. The rifle barrel is strapped to the lathe bed, the indicator is fastened in a manner similar to the turning set-up, and the piece is bored to the contour of the barrel. The barrel block is afterward sawed out of this piece in the miller. In Fig. 2 is shown an end view of a finished barrel block.

The same principle is used to advantage on the milling machine when milling the flutes in the formed cutters, as in Fig. 4. The barrel is strapped to the table and the indicator is fastened to the arbor support. The vertical center of the milling cutter is set to correspond with the point of contact of the indicator on the rifle barrel and, after setting the milling cutter to depth, the table is fed by power towards the small-diameter end of the cutter blank. The operator, watching the indicator, feeds the table up by hand as the blank travels under the milling cutter.

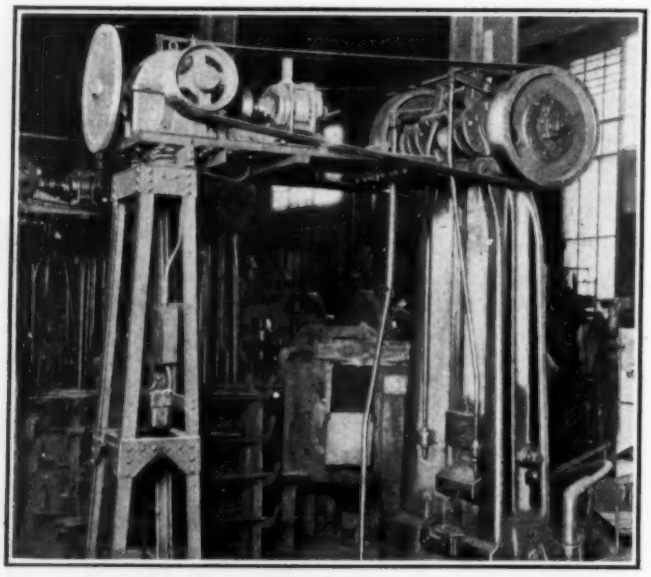
These methods are applicable to many odd jobs, and have the advantage of being quickly and easily set up, with no special tools or cams to be made.

Motor Drive for Drop Hammers

FRANK C. HUDSON

Motor drives are not nearly as common on drop hammers as on most other classes of machine equipment, largely because of the problems involved. The illustration shows how motors are applied to the hammers in the drop forge department of the General Electric Company.

The motor and the gear-reducing transmission are mounted on a spring-supported platform at about the



Motor applied to drop hammers

height of drive pulley on the drop hammer. The gear reduction drive-shaft carries a flywheel to store energy for handling the sudden load applications when the rolls start to raise the hammer head.

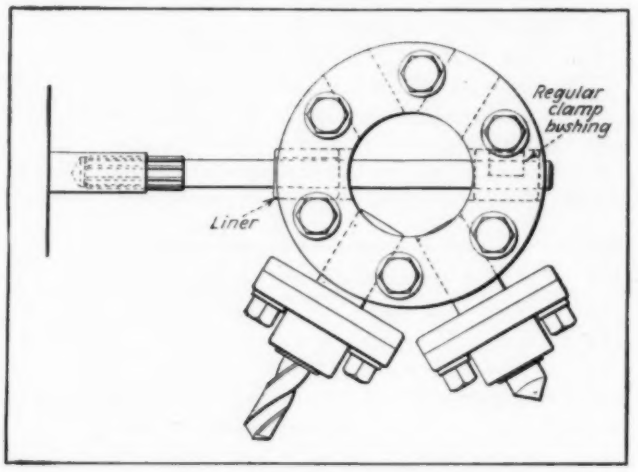
A steel structure, mostly of angles, supports the reduction-gear set, springs being interposed to give flexibility to the mounting. This arrangement gets the driving mechanism up out of the way and gives a horizontal belt drive.

Tool Held in Back Hole of Turret

BY HENRY SIMON

Jena, Germany

While ordinarily there is sufficient length for holding internal cutting tools on automatic screw machines, cases arise where twice as much would be welcome. One reason, for instance, why reamers are commonly held floating, is not so much because of inaccuracies in the alignment of the turret or spindle of the machine, but because on the one hand an angular error is almost certain to arise from clamping the tool shank and the bushing in the turret, while on the other hand a short, stubby shank has no chance whatever to give and thus center the tool in the work.



Avoiding the use of the floating holder

A way in which tools with long shanks can sometimes be held to advantage is shown in the illustration. As will be seen, it merely consists in using the turret hole farthest away from the chuck for clamping the tool, the shank passing through the front hole. In the instance shown, the reamer is held by the regular clamp bushing in the back hole, a liner bushing having a hole a few thousandths larger than the tool shank being placed in the front hole. Such a liner is not always necessary but is often advisable to prevent accidental bending, and to insure that the tool will start properly into the work.

From the illustration it will be seen that the length of the tool from the point of the work to where it is held, is about four times that possible with a floating holder, and at least twice as great as when using a floating bushing clamped in the front hole. The effect of any error existing in the alignment of the turret and the spindle is, therefore, not only greatly reduced, but any misalignment will be partly compensated for by the springing of the long shank.

There is, of course, no reason why a floating bushing should not be used instead of the clamp bushing in the rear hole, especially when a liner is used in front. That, however, will usually be superfluous where the tool is held from the rear hole, because the resultant error is no greater than that arising from the floating arrangement commonly used, which is that of a loose connection between the reamer shank and the bushing by means of a cross pin. Though this arrangement permits a certain amount of float, an analysis of the action obtained will make it clear that it is by no means perfect, a fact that

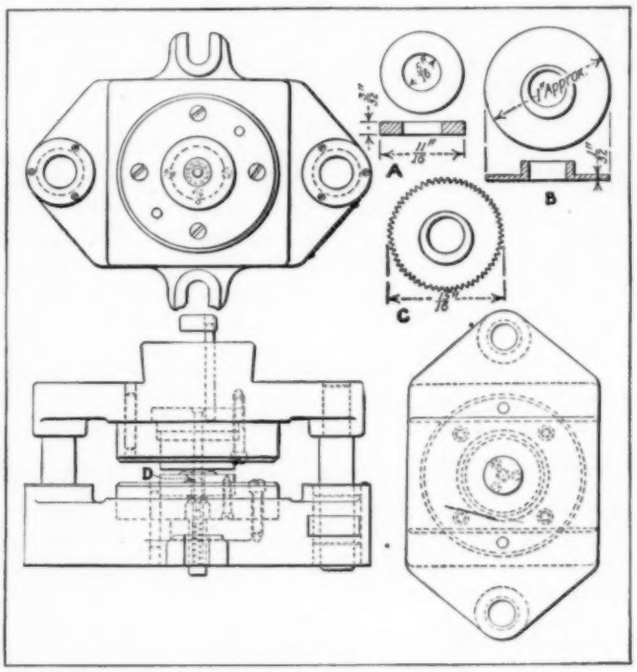
is testified to by the trouble often experienced to get a reamer thus held to cut to size.

In set-ups that are not crowded, and where one or two holes are free, it will often pay to so design the cams that the arrangement shown may be used. With cams already made, it will be possible, by merely timing the indexing in a slightly different manner, to use this method of holding.

Swaging Die for an Eccentrically-Shaped Part

By George H. Feltner

Among the advantages made possible by the use of swaging dies are the reduction of material required to form a given shape, and simplification of the method of manufacture. An example, embodying these features, is illustrated, which represents a die for cold-swaging a sheet-metal blank so that an eccentric hub is formed as shown. The blank before swaging is $\frac{3}{32}$ in. in thickness, and $\frac{11}{16}$ in. in diameter, with a $\frac{5}{16}$-in. hole as outlined at *A*. The portion of the blank forming the eccentric, retains its original thickness, and the metal



Constructional details of the swaging die

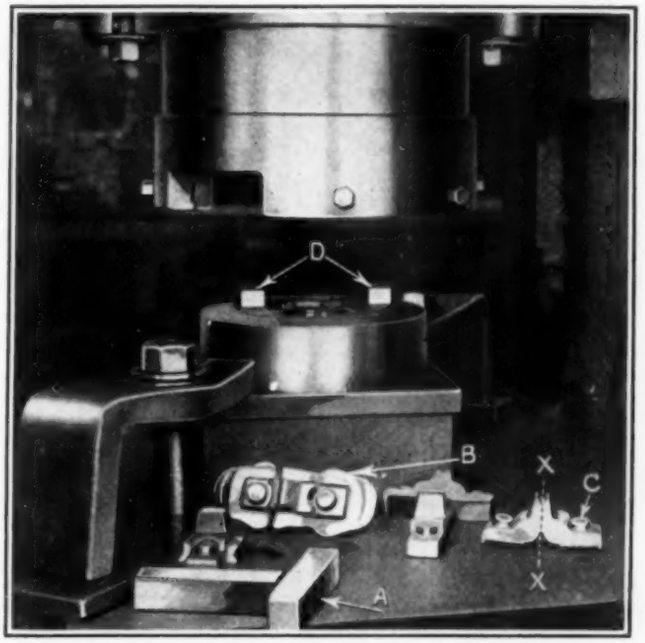
surrounding it is swaged to $\frac{1}{32}$ in. as indicated at *B*. The outside is trimmed to the form shown at *C*, in another operation. To make a part, such as the one shown, by some other means of machining, would necessitate a more complicated layout of operations.

The swaging die embodies simplicity in that it consists chiefly of a pillar-press die-shoe assembly, fitted with a hardened and polished punch and die. The blank is placed by hand on the die so that it is approximately centralized. Then, a pin in the punch assembly enters the hole of the blank, aligning it concentrically before the swaging takes place. The die has attached to it the spring-controlled ejector *D*, arranged to lift the work by its hub from the die on the upward stroke of the ram. The die is made somewhat heavier than the usual run of dies since a pressure of 400 tons is required for swaging.

Forging Contact Holders in Pairs

By Frank Waldo

In the illustration is shown a set of brass-forging dies, attached in a power press, used for making electrical contact-holders. Unlike the usual forging operation, the contact holders are made in pairs and then cut apart in a power saw, being held in a fixture so that the cut will be made in the proper place. A square slug, as outlined at *A*, measuring 1x1x4 in., is heated to the proper forging temperature, placed in the dies, and then forged to the shape shown at *B*. In this condition, the flash is



Dies for forging brass contact-holders

trimmed so that the forging appears as shown at *C*, ready for the sawing operation through *XX* as indicated.

The upper and lower die blocks consist of high-speed steel inserts, supported by carbon steel rings. Two tongues *D*, integral with the lower die, fit corresponding grooves in the upper die, so that the dies maintain alignment, thus assuring accuracy in the finished forging.

Developing an Accurate 60-Degree Angle Gage

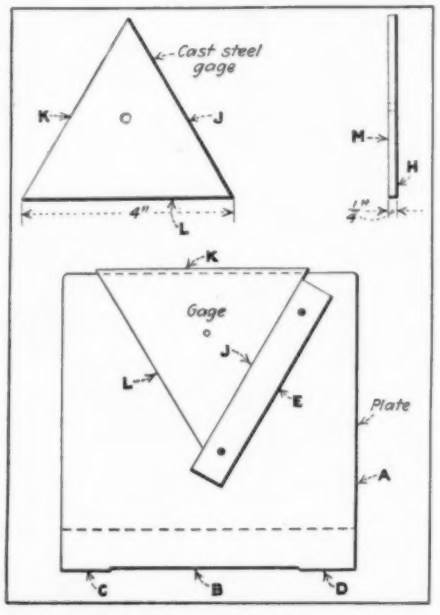
By Harry D. Summerfield

Some years ago the writer, was assigned the task of developing an accurate equilateral triangle to be used as a master angle for checking thread gages, the form of which was projected upon a screen and magnified forty diameters. It will be obvious that angular accuracy of the master (when we consider the magnification that takes place) is absolutely essential. The master was made of flat-ground, cast steel $\frac{1}{4}$ in. thick, and the length of each side was 4 in. The piece was first hardened and then rough ground to the angle by protractor. Three methods of accurately grinding and lapping the angles were then considered. The first method was to set a sine-bar to the 60-deg. position, and with the master against the sine-bar to grind each side. This method was discarded, owing to the impossibility of setting the

sine-bar accurately to an angle greater than 45 degrees.

The next method considered was to set buttons equidistant, and grind each side parallel with two of the buttons by fastening the master to an angle plate and setting two of the buttons in a parallel plane by indicating over them with a precision indicator. This method, while having certain advantages over the first one, was discarded as being too cumbersome; in other words, too many factors had to be considered.

The third method, which was adopted, proved entirely satisfactory. It was as follows: A suitable cast-iron angle plate *A* was procured, and a clearance *B* about 0.010 in. deep was machined out of the bottom side, leaving two narrow strips about ½ in. wide at *C* and *D*. The reason for this clearance will be noted later. The next step was to secure, by means of two screws, a small parallel strip *E*, to the angle plate, setting the strip as close to 60 deg. as possible by a protractor. The master angle was then fastened to the angle plate by means of a screw through the center hole, face *H* being placed against the angle plate with side *J* bearing against the parallel strip *E*, after which a cut was taken on side *K*. After side *K* was ground, the master was turned, and side *K* was placed against the strip, and side *L* was ground. Again the master was turned and side *L* was placed against the strip and side *J* was ground. This completed the first trial grinding of all three sides.



Fixture used to grind an accurate 60-deg. angle gage

The next step was to bring side *K* back again for regrinding, but this time the master was reversed and face *M* presented to the angle plate. This movement brought side *L* against the strip, whereas the first time side *K* was ground we were locating from side *J*. It will be obvious that any deviation from a true 60 deg. in the strip *E* will be doubled with the master reversed and can be quite easily detected by heavy grinding on either end of the side being ground. The next step is to correct the error shown. Since this error will be very small, the best method is to scrape the strips *C* or *D* according to the direction of error, thus correcting the angle of strip *E*. It will now be seen, that by reversing the master after each revolution of grinding, and correcting the error, if any, by scraping the bottom of the angle plate, we come to a point eventually, where we get an even spark on the grinding wheel from all sides and from either face. Thus we have generated three perfect 60-deg. angles, much in the same manner as originating a flat surface by scraping three surfaces alternately.

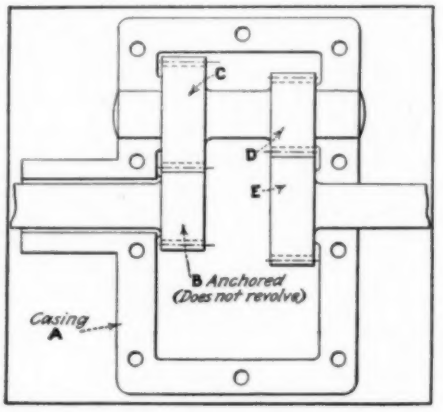
The same method is followed in lapping the sides of the master by using an indicator, of course, in place of the grinding wheel.

Practical Shop Problems

Questions of a Practical Nature will be answered in this column

Calculating Reduction Gears

Q. We shall feel obliged if you will assist us with the following gear problem: On the accompanying drawing A *is a revolving gear case,* B *is a stationary gear wheel,* C *and* D *are two gear wheels formed on one common shaft, and* E *is driven by* D. *We wish to get a definite reduction of* $2\frac{3}{4}$ *to 1 between casing* A *and gear wheel* E, *both* A *and* E *to revolve in the same direction. As the only gears we had available for a rough test were two sets of lathe change wheels, 19 wheels per set, from 20 teeth to 110 teeth, we were only able to get approximately near to the reduction required. We found that with 60 teeth for* B, *75 for* C, *60 for* D, *and 75 for* E, *we got a reduction between* A *and* E *of a little more than* $2\frac{3}{4}$ *to 1. Can you tell us the number of teeth required in each gear to give us this ratio? We prefer to have the number of teeth in* B *equal to those in* D, *and the number in* C *to equal those in* E, *but this is not essential.*



A. The following solution is offered by Professor Earle Buckingham:

This is a planetary gear drive and the formula for the reduction ratio is $1 - \frac{F \times Ps}{Pf \times S}$, where F is the fixed gear B, Pf is the planetary pinion C on the sketch, S is the sun gear E on the sketch, and Ps is the planetary pinion D on the sketch. Using the symbols on the sketch we have:

$$\text{Reduction ratio} = \frac{1}{2.75} = \frac{4}{11} = 1 - \frac{B \times D}{C \times E}$$

If B equals D and C equals E, we have:

$$\frac{4}{11} = 1 - \frac{B^2}{C^2} \quad \text{or} \quad \frac{B^2}{C^2} = \frac{7}{11}$$

There is no exact solution for this combination since $\frac{7}{11}$ is not a perfect square. We can obtain a close approximation, however, and when B and D equal 63, and C and E equal 79, the reduction ratio is 2.7469, which is very close to the required reduction. If the exact solution is required then: $\frac{B \times D}{C \times E} = \frac{7}{11}$ and various combinations could be used such as $\frac{70 \times 100}{100 \times 110}$. If $B + C$ must equal $D + E$, so as to use the same pitch on all of the gears, then the ratio $\frac{70 \times 90}{110 \times 90}$ could be used.

Standard Bolt Heads and Nuts

The standards for bolt heads and nut sizes shown in the accompanying tables were recently approved by the American Engineering Standards Committee. These standards are intended to introduce national uniformity and to supersede all existing standards of bolt heads and nuts. The dimensions listed are claimed to be in accord with the tendency toward smaller sizes for heads and nuts. Such reductions were made, however, only after consideration of the stresses and after many tests.

Table I—Rough and Semi-Finished Square and Hexagonal Regular Bolt Heads

Diameter of Bolt D	Width Across Flats Maximum	Width Across Flats Minimum	Minimum Width Across Corners Hex.	Minimum Width Across Corners Square	Height Nominal	Height Maximum	Height Minimum
¼	0.3750	0.363	0.414	0.498	11/64	0.188	0.156
5/16	0.5000	0.484	0.552	0.665	13/64	0.220	0.186
⅜	0.5625	0.544	0.620	0.747	¼	0.268	0.232
7/16	0.6250	0.603	0.687	0.828	19/64	0.316	0.278
½	0.7500	0.725	0.827	0.995	21/64	0.348	0.308
9/16	0.8750	0.847	0.966	1.163	3/8	0.396	0.354
⅝	0.9375	0.906	1.033	1.244	27/64	0.444	0.400
¾	1.1250	1.088	1.240	1.494	1/2	0.524	0.476
⅞	1.3125	1.269	1.447	1.742	19/32	0.620	0.568
1	1.5000	1.450	1.653	1.991	21/32	0.684	0.628
1⅛	1.6875	1.631	1.859	2.239	3/4	0.780	0.720
1¼	1.8750	1.813	2.067	2.489	27/32	0.876	0.812
1½	2.2500	2.175	2.480	2.986	1	1.036	0.964
1¾	2.6250	2.538	2.893	3.485	1 1/32	1.196	1.116
2	3.0000	2.900	3.306	3.982	1 11/32	1.388	1.300
2¼	3.3750	3.263	3.720	4.480	1½	1.548	1.452
2½	3.7500	3.625	4.133	4.977	1 23/32	1.708	1.604
2¾	4.1250	3.988	4.546	5.476	1 53/64	1.885	1.773
3	4.5000	4.350	4.959	5.973	2	2.060	1.940

Table II—Finished Square and Hexagonal Bolt Heads

Diameter of Bolt D	Width Across Flats Maximum	Width Across Flats Minimum	Minimum Width Across Corners Hex.	Minimum Width Across Corners Square	Height Nominal	Height Maximum	Height Minimum
¼	0.4375	0.428	0.488	0.588	5/16	0.194	0.180
5/16	0.5625	0.552	0.629	0.758	13/64	0.242	0.227
⅜	0.6250	0.613	0.699	0.842	9/32	0.289	0.273
7/16	0.7500	0.737	0.840	1.012	21/64	0.337	0.319
½	0.8125	0.799	0.911	1.097	3/8	0.385	0.365
9/16	0.8750	0.861	0.982	1.182	27/64	0.433	0.411
⅝	0.9375	0.922	1.051	1.266	15/32	0.481	0.457
¾	1.1250	1.108	1.263	1.521	9/16	0.576	0.549
⅞	1.3125	1.293	1.474	1.775	21/32	0.672	0.641
1	1.5000	1.479	1.686	2.031	3/4	0.768	0.733
1⅛	1.6875	1.665	1.898	2.286	27/32	0.863	0.824
1¼	1.8750	1.850	2.109	2.540	15/16	0.959	0.916
1½	2.2500	2.222	2.533	3.051	1⅛	1.150	1.100
1¾	2.6250	2.593	2.956	3.560	1 5/16	1.341	1.284
2	3.0000	2.964	3.379	4.070	1½	1.533	1.468
2¼	3.3750	3.335	3.802	4.579	1 11/16	1.724	1.651
2½	3.7500	3.707	4.226	5.090	1⅞	1.915	1.835
2¾	4.1250	4.078	4.649	5.599	2 1/16	2.106	2.019
3	4.5000	4.449	5.072	6.108	2¼	2.298	2.203

Table III—Finished Hexagonal Cap Screw Heads

Diameter of Screw D	Width Across Flats Maximum	Width Across Flats Minimum	Minimum Width Across Corners	Height Nominal	Height Maximum	Height Minimum
¼	0.4375	0.428	0.488	5/16	0.194	0.183
5/16	0.5000	0.489	0.557	13/64	0.242	0.227
⅜	0.5625	0.551	0.628	9/32	0.289	0.273
7/16	0.6250	0.612	0.698	21/64	0.337	0.319
½	0.7500	0.737	0.840	3/8	0.385	0.365
9/16	0.8125	0.798	0.910	27/64	0.433	0.411
⅝	0.8750	0.860	0.980	15/32	0.481	0.457
¾	1.0000	0.983	1.121	9/16	0.576	0.549
⅞	1.1250	1.106	1.261	21/32	0.672	0.641
1	1.3125	1.292	1.473	¾	0.768	0.733
1⅛	1.5000	1.477	1.684	27/32	0.863	0.824
1¼	1.6875	1.663	1.896	15/16	0.959	0.916

Table IV—Set Screw Heads

Diameter of Screw D	Width Across Flats Maximum	Width Across Flats Minimum	Height Nominal	Height Maximum	Height Minimum
¼	0.2500	0.241	3/16	0.197	0.179
5/16	0.3125	0.302	15/64	0.245	0.224
⅜	0.3750	0.362	9/32	0.293	0.270
7/16	0.4375	0.423	21/64	0.341	0.315
½	0.5000	0.484	⅜	0.389	0.361
9/16	0.5625	0.545	27/64	0.437	0.407
⅝	0.6250	0.607	15/32	0.485	0.452
¾	0.7500	0.729	9/16	0.582	0.544
⅞	0.8750	0.852	21/32	0.678	0.635
1	1.0000	0.974	¾	0.774	0.726
1⅛	1.1250	1.097	27/32	0.870	0.817
1¼	1.2500	1.219	15/16	0.967	0.909
1½	1.5000	1.464	1⅛	1.159	1.091

All dimensions in the tables are in inches. The tolerances on the nuts are allowed downward from the nominal size. The width across the flats of bolt heads is 1½ D with a few exceptions, and with adjustments to eliminate 1/32-in. wrench openings. In Table I the tolerance for the width across flats is minus 0.50 D. The height of the head is ⅔ D, and the tolerance for the height is 0.32 D + 0.024. The top of the bolt head is flat and chamfered. In Table II the tolerance for the width across flats is 0.015 D + 0.006. The height of the heads from the top of the head to the under size of the washer face is ⅔ D. All finished bolts are washer faced, with thickness of washer faces 1/64 in. In Table III the tolerance for the width across flats is 0.015 D + 0.006, and the height of the heads is ⅔ D. All cap screws are washer faced. The width across the flats of set screw heads is equal to the diameter, and the height of the heads is ⅔ D. The width of the neck under the head is twice the pitch of the thread. The radius of the crown of the head is 2½ D.

(Continued on sheet 14A)

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Technical Abstracts

Sheet Insulating Material

Broadly, an insulating material is one that does not conduct electric current. This, of course, is true only in the case of an ideal insulator. It is more accurate to consider an insulator as being a very inefficient conductor, and if we inquire as to the resistance of an insulating material, we are doing nothing more than determining whether or not the resistance is sufficiently high to prevent current leakage of an objectionable amount. The insulation resistance of all materials drops rapidly during humid weather, in most cases to a small fraction of its original value when dry. The three insulating materials most widely used in sheet form for the construction of telephone apparatus are: Hard rubber, phenol fibre, and vulcanized fibre.

Hard rubber is an excellent insulator, and can be made in various grades. Of these, some are suitable for difficult machining operations, such as in the tip mountings for jacks and lamp sockets, while others are suitable for spring assembly. Hard rubber, however, has some objectionable qualities. Insulators of hard rubber are difficult to keep tight. Unless the clamping areas are large, the hard rubber gradually flows from under the clamping surface, resulting in loosening of the piece. This yielding is commonly called cold flow. It takes place at ordinary temperatures, but becomes very noticeable above 100 deg. F. Hard rubber also deteriorates when exposed to the light.

The objections to the use of hard rubber led to an extensive search for better materials. Of those furnished, phenol fibre proved to be the most satisfactory substitute. Phenol fibre is a laminated product made in convenient thicknesses from sheet paper treated with a varnish made from phenol and formaldehyde. The treated sheets are stacked to the desired thicknesses and cured into a solid mass by heat and pressure. A number of phenol fibres are marketed under trade names, such as Bakelite-Dilecto, Formica, Micarta, Condensite-Celoron, and Phenolite. The varnish used in the manufacture of all these parts is obtained from the Bakelite Corporation of America. Cold flow is absent in phenol fibre, which has had most to do with its wide application as a substitute for hard rubber. But phenol fibre is not as readily machined as hard rubber, and before a punching operation, it is generally necessary to heat it to reduce the brittleness.

Vulcanized fibre is also used in large quantities. The term "vulcanized" is a misnomer, since heat and sulphur are not used in its manufacture, as in the preparation of hard rubber, nor is it cured by heat and pressure, as is phenol fibre. It is made from a rag stock paper, which has been treated with zinc chloride to soften the cellulose fibres. The outstanding characteristics of vulcanized fibre are: Toughness, adaptability to machine processes, and low cost. Its strength and toughness make it the most desirable insulating material for the strain of severe wear and mechanical abuse. Unfortunately, however, it has a tendency to cause corrosion of current-carrying parts. Another serious objection is that, under high humidity, considerable swelling and warping occur. Under adverse weather conditions it is generally considered unsatisfactory for insulating terminals in talking circuits. —J. M. Wilson, *Bell Laboratories Record*, October.

Practical Features of Pickling

Before successful pickling of iron or steel can be accomplished certain things must be done.

The material must be classified, whether iron or steel. The surface of the steel base must be free from oil, grease, drawing compounds, etc., before being pickled. Grease, etc., that is too heavy to be removed by metal cleaners must be burned off. The amount of zinc deposited as galvanized coating should be figured on the pickled weight basis and not on the black weight of the steel base.

The amount of zinc deposited varies with the thickness of the steel base, the surface area, the kind of scale removed, the length of the pickling time, and the treatment the steel base has had in fabrication. The scale on forgings, heavy plates, pipes, etc., is heavy and harder to pickle off than light scales on sheets. The chemical composition of the steel base affects the pickling time and also influences the spangle and the weight of coating. When the steel base has a heavy rust burned into the surface, the material should first be pickled in cold acid over night. This will remove the rust without burning the steel base. Heavy scale on small articles can be almost entirely removed by tumbling previous to pickling.—Wallace G. Imhoff, *Iron Trade Review*, Oct. 27.

Commercial Aviation Is Growing

Ocean flights and records make us overlook what is being done in commercial aviation, both actual and projected. December 1 is expected to see a daily airline in operation between Chicago and New Orleans, with a 9 hr. schedule. Another line is being planned from Denver to New Orleans.

Airports are being established in many places. St. Louis is planning the purchase of Lambert field by bond issue, Mr. Lambert in the meantime renting the field for $1 a year.

Passenger carrying is growing rapidly in the Los Angeles district, not only in the matter of sight seeing but with regular daily trips to San Diego, 127 miles, with capacity loads in each direction. Sight seeing excursions vary from $5 to the Santa Monica Palisades to the $20 trip that circles the summit of Mt. Wilson.

The first month of passenger carrying service by the National Air Transport, Inc., handled 107 passengers out of Chicago. Of these 90 flew from Chicago to Dallas, the rest coming to New York. During this same month the planes carried over 50,000 lb. of mail on the Chicago-New York service and over 9,000 lb. on the Dallas Branch. Air express totaled 5,163 lb., 450 of this going on the Dallas line. Chicago is also building a large municipal landing field that will have 3½-mi. of solid cinder runways so that planes of any size can take off and land in any direction.

San Francisco reports that 371 planes of all types, and 673 passengers, took-off from or landed at Mills Field during September, without a single mishap. This is the municipal airport and the revenue is increasing so that there is every indication of its becoming self-supporting. As with the automobile, the airplane will create business wherever it is used.—*Aviation*, Oct. 31.

Power-Factor Correction

Power factor correction in any industrial plant should be preceded by an engineering analysis of the plant as to its operating conditions. In the example cited in the original article, power was purchased under a penalty and bonus rate system for power factor. A survey was first made of the connected load, machine operation, duty cycles of machines and plant motorization. Distinct possibilities of reducing the amount of corrective kilovolt amperage by revamping the motorization of the plant was revealed.

Tests proved that many motors were too large for the loads they were operating. In one case a 5-hp. motor was being used in place of a 3-hp. motor that had burned out on the job. Actually the load could be carried by a 1½-hp. motor of the proper type and would operate under a much better power factor. By following this analysis through the plant, it was found that, by the purchase of a total of 3 hp. in new motors, 30 hp. could be removed from service. This reduction in over-motorization alone reduced the corrective power factor considerably.

Several means for correcting the

power factor of the plant were considered. Synchronous motors were not included because the largest motor in the plant was only 25 hp. Synchronous condensers at the metering point were also eliminated because of their lack of economy. Group static condensers at the metering point could be installed at a cost of approximately half of individual static condensers at the motors, but the saving per year would only be half as much, approximately. An analysis showed that the installation of 96 kva. individual condensers would maintain a plant power factor of not less than 95 per cent and would produce a saving of $1,800 per year in removing charges for low power factor, and not less than $1,200 per year in reduced demand and kilowatt hour consumption.

After the installation was made tests showed that the average saving was $287 per month and that the power factor was never below 97 per cent. In addition to these favorable results many other advantages were gained: Excessive heating of the distribution wiring was eliminated, fuse blowing was mate rially reduced, maintenance work was reduced approximately 75 per cent, and maintenance materials were reduced in the same proportion.—W. J. Herrick, *Electrical World,* Oct. 15.

Aluminum Bronzes

Aluminum bronzes are alloys of copper and aluminum with a density generally greater than 7 and for that reason called "heavy." There are also copper-aluminum alloys containing small quantities of such elements as nickel, manganese or silicon, to modify to a certain extent the mechanical or chemical characteristics of these bronzes, which are then called "special," these are only mentioned here.

Aluminum bronzes occupy a predominant position among non-ferrous alloys and are much used in modern machine construction, due to highly desirable qualities possessed by them; but for a long time, after their discovery by Ste. Claire Deville, certain difficulties, inherent to their production under manufacturing conditions, impeded their large-scale application. Now these difficulties have been surmounted in practice—they are chiefly of the following nature:

1. Aluminum bronzes have a very large contraction co-efficient at solidification, this varies from 1.7 to 1.9 per cent according to the aluminum content.
2. Great quantities of gases are emitted during solidification.
3. It is very essential to eliminate all traces of aluminum oxide present, but the latter has a tendency to remain in suspension in the molten metal and does not easily ascend to the surface.

Generally the aluminum bronzes used in industry have from 7 to 12 per cent of aluminum. With less than 7 per cent of aluminum the characteristics of copper are not appreciably modified; above 12 per cent—the alloy becomes brittle. The alloy is used either cast or shaped, i.e. rolled, forged or stamped. From the point of view of its shaping the alloy may be divided into two groups: (1) with less than 9 per cent af aluminum, (2) with more than that amount. The first group can be worked either cold or hot. The second group can only be worked hot and the proper range of temperatures is between about 1300 and 1650 deg. F. or, in other words, at temperatures much higher than for ordinary bronzes containing zinc.

Aluminum bronzes used for castings contain from 8 to 10 per cent of aluminum. If cast in sand or metal molds, with due consideration to the special difficulties mentioned above, perfectly sound castings will be obtained. Die casting has not yet proved practicable as the melting temperature of the alloy is too high (from 1890 to 1920 deg. F.).

It is very interesting to note that aluminum bronzes can be heat treated somewhat like steel. They can be hardened, drawn and normalized, and show corresponding changes of internal structure related to changes of physical properties.

As an example we will take an aluminum bronze with 10 per cent of aluminum hardened at 1650 deg. F. by quenching in water. If drawn to a temperature of 570 deg. F. it will show a tensile strength of 108,000 lb. per sq.in. with an elastic limit of 68,000 and an elongation of 2 per cent.

If, on the other hand, the drawing temperature is 1470 deg. F., the tensile strength will be of 82,000 lb. per sq.in., the elastic limit 38,000, and the percentage of elongation 34.

It is very important to note that within a very appreciable range of temperatures the mechanical features of aluminum bronzes, among others their hardness, remain practically unaffected. This feature gives to such bronzes a marked superiority over steel in certain applications.

The density of aluminum bronzes, within the usual range of aluminum contents, from between 7 to 11 per cent, varies from 7.9 to 7.3. A very important property of these alloys is their resistance to corrosion under most conditions encountered in practice. They have given remarkable results in marine constructions in resisting the action of sea water, also in cases where acid resistance was essential.

The microstructure of aluminum bronzes shows fine hard crystals evenly embedded into a softer cement. This is a very favorable condition for high antifriction qualities, and experiments have shown that bushings made of these alloys have a co-efficient of friction smaller than 0.022. Their high thermal conductivity is also a very valuable asset in bearing linings as it helps to keep them cool.

All aluminum bronzes with about 10 per cent of aluminum have the aspect of green gold and take a very high polish, practically intarnishable, even at temperatures as high as 1550 deg. F.—A. P. B., *La Revue Industrielle,* September.

Carburization of Steel

Experiment has proved that, under ordinary conditions, carbon itself does not carburize steel. Air is necessary to form carbon monoxide, which then decomposes into free carbon and carbon dioxide when brought into contact with heated iron. This free carbon, assumed to be in the atomic state, forms an alloy with the metal, known as cementite.

Carbon monoxide concentration is regulated by luting practice only, although the ratio of monoxide to dioxide, which is a function of the character and depth of the case, is determined by the selection of the carburizing mixture. Air-tight containers have been resorted to in order to obtain a higher gas pressure than atmospheric, but it is doubtful what effect this procedure has on the quality of the case.

The amount of carbon absorption is a function of the time, the composition of the gas and its temperature and pressure. Carbon distribution and the character of the case is regulated by the carburizing temperature and cycle, composition of the metal, and its subsequent heat-treatment. The carbon first alloys with the superficial layer of gamma iron, but constant migration of carbon atoms within the piece prevents saturation being reached. As the temperature is increased, the speed of absorption and the depth of case are increased. However, lower carbon concentration in the different zones results. Too high a temperature results in exaggerated grain growth in the core, and this condition is detrimental. Too low a temperature gives a thin case with abnormally high carbon content, or, in some cases, no carbon at all. Heating to the carburizing temperature has no effect upon the case, although too rapid heating will often result in warpage. Similarly, too rapid cooling sometimes results in peeling of the carburized layer.

Primary distribution of cementite is inductive to the best properties in the finished article and, generally, quenching from the pot is specified for its preservation. Slow cooling, re-heating, and quenching cannot affect the unevenness of carbon distribution, although long annealing is effective.

Nitrogen has a pronounced affinity toward iron when it comes in contact with the metal at elevated temperatures; it forms iron nitride. This compound has considerable hardness and is useful when an adequate case cannot be produced by carbon alone. Cyaniding is an example of such absorption. Steel, when placed in molten sodium or potassium cyanide, rapidly alloys with the atomic carbon and nitrogen set free on their decomposition. This reaction takes place at a much lower temperature than that necessary for simple carburization, and in a much shorter time.

Carburization with carbon monoxide alone, without solid carbon, is becoming quite general, particularly with alloy steels because of the uniformity of case produced.—John D. Gat, *Forging, Stamping, Heat-Treating,* October.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Balancing Machinery

TIME was, in the early days of explosion engines, when we were not much moved as to just how quietly they ran, but decidedly anxious as to whether they would run at all. Now, even with engines in the lower priced cars, we are very fussy as to their being quiet and spend much time and money to eliminate noises and vibrations of different kinds. To overcome this objection nearly every engine plant is testing for everything that affects balance, which in turn makes for vibration, noise and shorter life.

As a result we are getting engines that run much more quietly and with less wear—hence have longer life between repairs. Freedom from vibration should perhaps be considered more carefully by builders on other machines. For even a slight variation may affect the kind of finish left by a tool or a grinding wheel, and this in turn shorten the life of the machine into which it goes.

Balancing does not seem to find a place, as yet, in the shops of many builders of machines, except those who build machines of such distinctly high speed that vibration becomes annoying if not dangerous. It is quite probable that vibration also affects slower speed machines, even though it is not so noticeable. Unbalanced electric motors are sometimes a great problem on this account, especially when they must be mounted on the machine itself.

Doesn't it seem reasonable that we may have to pay more attention to balancing such parts of lathes or other machines as run at even moderate speeds? Perhaps not the work spindles so much as other, higher speed shafts. In any case, a balanced rotating member is certain to function more satisfactorily in any machine.

Laboratory Control

IT WOULD be hard to imagine a higher compliment to the laboratory than that paid by a hard-headed plant manager of one of our large corporations. He remarked that their long experience with the three or four metals used in their product had led them to believe that they knew all there was to know about the handling of those metals. In spite of this perfect knowledge certain things continued to go wrong periodically. The difficulties were so persistent that they came to be looked upon as a handicap inseparable from manufacturing, and to be treated philosophically as unavoidable.

Since the physical and chemical laboratory established recently by the corporation has been functioning the old "unavoidable" difficulties have vanished. Production flows along much more smoothly and consequently at less expense. The secret, of course, is that the laboratory men have substituted exact technical knowledge for traditional ideas and scientific control for the rule of thumb. Equal benefits can be secured by any organization if it will take steps to accomplish the same ends.

Extending the Navy Inspection Services To Other Departments

CO-OPERATION between government departments is increasing in a commendable manner. A recent bulletin issued by the Chief Co-ordinator of the Navy announces that the Naval Inspection System is available for field inspection work for any branch of Federal activities. In this way government activities that have no field inspection service of their own can utilize the naval service. The only expense will be whatever actual extra expense is incurred by the navy service in handling the work.

The value of this opportunity is further advanced by the comparatively recent consolidation of Navy inspection activities as was outlined by Capt. H. C. Dinger on page 59, Vol. 67 of the *American Machinist*. This consolidation has simplified the inspection service and made it more efficient in a number of ways. The extension of facilities to other departments should be of general benefit in helping to keep down the costs of government.

Another example of co-operation is to be found in the extension to practically all government departments of the navy system for the procurment of lubricants. A considerable saving should result, because the smaller government activities are enabled to secure the benefit of thorough investigation and test.

Co-operation of this kind is to be commended and it is to be hoped that the smaller departments will avail themselves of the opportunity offered. While no inspection service is perfect, it is easier to improve an existing service than to establish a new one.

Shop Equipment News

Cleveland No. 2 Combination Punching and Shearing Machine

PUNCHING, notching, shearing and splitting can be performed on the No. 2 combination machine made by the Cleveland Punch and Shear Works Co., Cleveland, Ohio. An attachment is also supplied for twisting bars. The machine runs at greater speed than previous types made by this company. As a whole it is neat in appearance and compact. All the working parts are readily accessible. Three men can work on the machine at the same time. Front and rear views are shown in the accompanying illustrations.

The frame is made of solid cast steel. The drive is through gears of wide face to assure long life. The clutches run in oil and automatic lubrication is supplied the flywheel shaft, the oil being filtered before entering the bearings. Three bearings are used to support the main shaft.

The die-block is designed to punch minimum and maximum sections in either webs or flanges without change. Dual stripper lugs take care of any stripping condition. The distance from the face of the die-block to the center of the die is variable so that single or triple punching attachments may be used. This distance may be varied without removing the punch blocks. Through bolts are used for these attachments.

Interchangeable triple gag attachments are also furnished. With them three sizes of holes may be punched in various gages at one set up. The punches may be placed either parallel or at a right angle to the main shaft of the triple gag. Long bearing surfaces of the stems are featured. Inoperative stems may be raised up out of the way.

The lower splitting shear blade is extended to furnish a support for the material when the cut is started. The trimmings fall clear and cannot damage either the blades or the machine. An internal notching attachment is regularly supplied for rectangular and 45-deg. notches, but an external attachment can also be furnished for the same purpose. The former is recommended, however, because of greater safety and decrease in overall space. The punching, splitting and angle cutting units are individually operated by means of four-jaw clutches.

With this machine, I-beams, 4 to 15 in., and columns, 4 to 8 in., inclusive, can be punched in either the flange or the web, while holes up to $1\frac{1}{16}$ in. in diam. can be punched in $\frac{5}{8}$-in. plates. The notching capacity is 6-in. I-beams, 8-in. channels, and 2 x 2 x $\frac{1}{4}$-in. angles. Angles and Ts up to 4 x 4 x $\frac{1}{2}$ in. can be squared off, or similar sections up to 3 x 3 x $\frac{1}{2}$ in. can be sheared at 45 deg. I-beams and channels of 6 and 9 in. respectively, can also be sheared, and plates up to $\frac{5}{8}$ in. can be split.

The machine is also furnished in a smaller and a larger capacity.

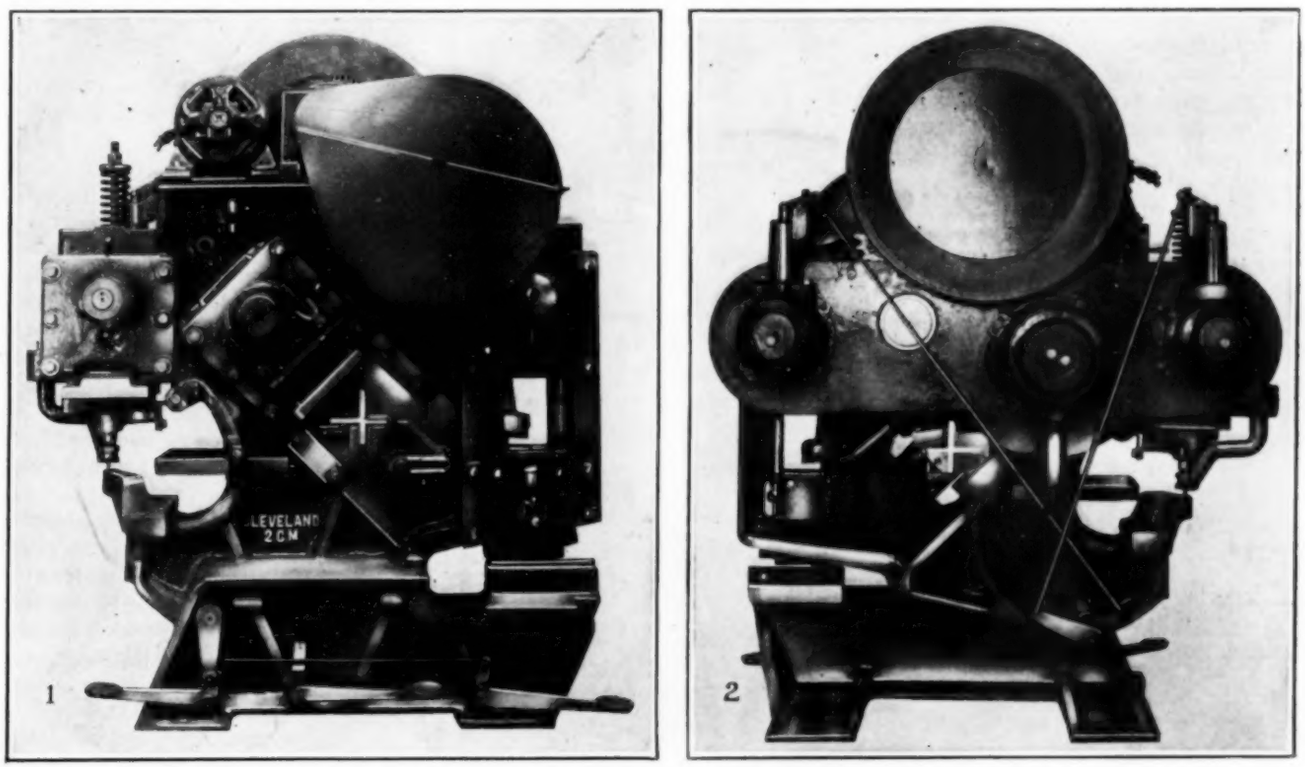


Fig. 1—Front view of the Cleveland No. 2 Combination Punching and Shearing Machine
Fig. 2—Rear view of the machine

Shop Equipment News

Nut-Burring Fixture for Besly No. 49 Disk Grinder

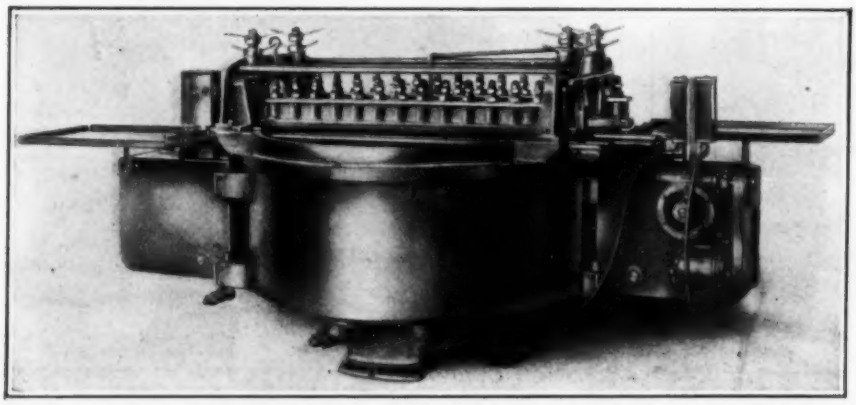
This special double fixture for grinding off the punch burrs on the bottom face of square and hexagon nuts is fixed to a special tub or main top casting of the No. 49, 53-in. disk grinder made by Chas. H. Besly and Co., 118 N. Clinton St., Chicago, Ill. The grinding unit is a standard Besly Model No. 49 with direct-connected motor and a vertical spindle.

The fixture consists of two parallel top bars carrying vertically-adjustable shoes with hardened steel faces that press down on the tops of the nuts. Side guide bars, which are adjustable in or out, provide a channel across the face of the grinding disk for various size nuts. The top bars are adjusted to give a slight slant down toward the discharge end and the shelf is adjusted to bring the nuts to a finished thickness alik

The top bars are carried by adjustable sleeves threaded with bosses in cross-yokes. These sleeves are graduated and held by lock nuts provided with cross-handles.

Work is fed from the loading pans, located conveniently to the guides, where it is pushed through the grinding channels by adjustable-stroke levers having hardened-steel push fingers. These feed levers are driven through ball-bearing cranks operated by a bronze wormwheel and a hardened steel worm, motor driven through the medium of a belt. Change of the speed of feeding can be made by changing the pulley diameters. The strokes may be varied from 50 strokes per minute for 1¼-in. nuts to 100 strokes for ⅝-in. nuts.

The complete feeding device is carried on two vertically-adjustable knees which can be varied and adjusted for wheel wear. Side guide bars are also attached to these knees which automatically keep these bars in proper relation to the grinding face of the wheel. A suitable dresser is carried on a bar across the face of the grinding wheel.

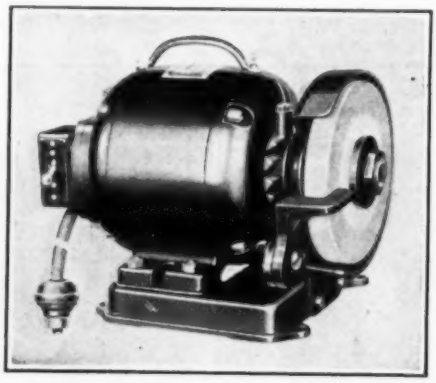


Nut-Burring Fixture for Besly No. 49 Disk Grinder

Master Motor-Grinder

This motor-grinder, shown in the illustration, made by the Master Electric Co., Linden and Master Aves., Dayton, Ohio, is intended especially for the small shop where the unit can be used either as a grinder or as a power motor. The unit can be belted either temporarily or permanently to a small drill press, lathe, jig saw, washing machine, fan or any other equipment for which a ¼-hp., split-phase motor is suitable. In addition it will do light grinding of all kinds.

The power unit is a Master type SA ¼-hp. split-phase motor, and has self-aligning, phosphor-bronze bearings with splash-proof guards. It will stand 200 per cent overload momentarily. By disassembling the grinding attachments, the motor, switch, cord and plug can be used as a standard motor. A d.c. motor type DM, can be supplied for operation on 32-, 115- or 230-volt lines. It is interchangeable with the type SA in its principal dimensions.



Master Motor-Grinder

Other parts of the equipment include an adapter pulley that holds the grinding wheel in place and also serves as a grooved pulley. The grinding wheel itself is 6 in. in diameter by ¾ in. thick and is supplied with a guard in conformance with safety regulations. The unit is mounted on a cast-iron base, which also supplies a support for the wheel guard. Attached to this wheel guard is a tool rest for both edge and face work. This support can be adjusted to any angle by loosening a wing nut. Each unit is provided with 10 ft. of conductor cord and a plug for insertion in a lamp socket.

Lebanon Split Ball Bearings

The Split Ball Bearing Corporation, Lebanon, New Hampshire, is putting out a line of split ball bearings for lineshafts and other applications where the placing or repair of single-piece bearings would involve taking down shafts and removal of pulleys or couplings.

The components of a complete bearing are: a sleeve, bored to fit the shaft, split longitudinally and held together with suitable screws and dowels; a bearing shell, also split longitudinally and held together by similar means; a sufficient number of balls to fill the races; and an equal number of spacers with which to separate the individual balls from each other.

The ball races—four or eight, according to whether it is a single- or a double-row bearing—are made in halves, formed, hardened and forced into corresponding grooves in the sleeve and shell, and swaged into place to hold them securely. They are then form-ground to diameter and radius. The halves of both sleeve and shell are marked with corresponding numbers so that parts that are ground together will remain together. Instead of a cage to hold the balls apart, cylindrical spacers, smaller in diameter than the balls and having concave ends, are placed endwise between the balls.

Shop Equipment News

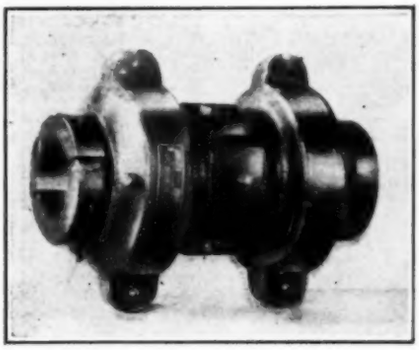


Fig. 1—Lebanon Split Ball Bearing for Lineshaft

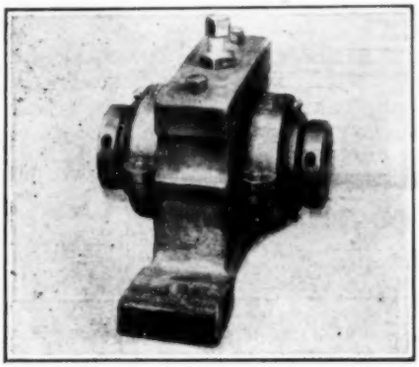


Fig. 2—Lebanon Split Ball Bearing in Pillow Block

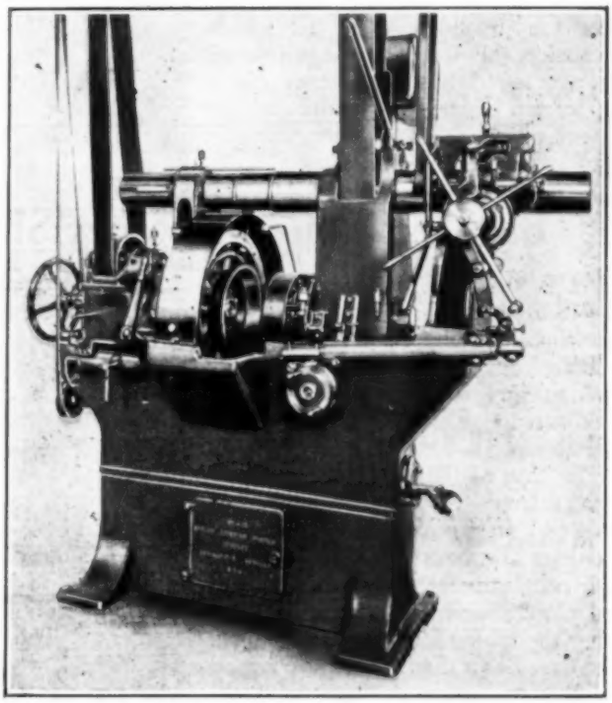
Bearings are made for all commercial sizes of shafting up to $2\frac{11}{16}$ in. Larger sizes are in preparation. The bearings fit any standard hanger and may therefore be substituted for plain and babbitt bearings of lineshafts without extensive alteration.

The assembled bearing is shown in Fig. 1, and in Fig. 2 the same bearing is shown held in a special pillow block of this company's manufacture.

Bryant Grinding Machine for Brake Drums

A machine especially designed and built by the Bryant Chucking Grinder Co., Springfield, Vt., to grind the brake drums of automobiles after the latter have been secured to the wheels is shown in the illustration. The swing of the machine is sufficient to take in the full diameter of a truck wheel, plus the space necessarily occupied by the chuck or holding device.

The machine has the characteristics of the regular Bryant grinding machine. The grinding head is carried upon a cylindrical bar mounted above the bed and has a traversing as well as a swinging movement upon the bar. Telescoping sleeves protect the bearing surface of the bar from injury by reason of abrasive dust. Automatic traversing movement is available to the wheel slide, or it may be operated by hand, if desired. Cross feed is applied by swinging the head upon the bar. The workhead is driven through steel herringbone gears from a two-speed overhead countershaft. The front bearing of the work spindle is of exceptionally large diameter to provide rigid support close to the work. The spindle is stopped and started by means of a clutch. The holding chuck is designed to hold the work by the wheel rim, and may be operated manually or by compressed air. A substantial guard encircles the chuck and work. The wheel spindle runs on Timken bearings and is driven by a 5-in. belt. It is designed to swing a wheel 11 in. in diameter.



Bryant Grinding Machine for Brake Drums

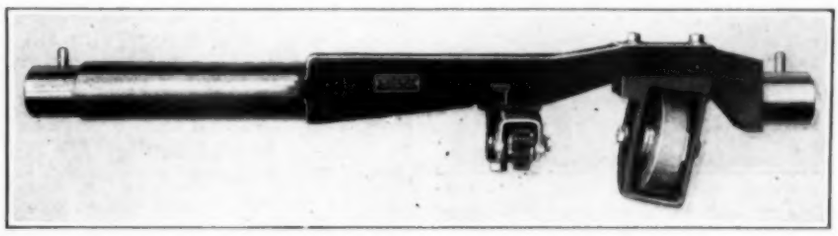
Ross Wheel-Truing Unit for Landis Hydraulic Crankpin Grinder

Economy and speed without the sacrifice of finish are claimed as advantages of a wheel-truing device made especially for the 16-in. Landis hydraulic crankpin grinder. The device was recently introduced by the Ross Manufacturing Co., Cleveland, Ohio.

The unit consists of a bar of special alloy that fits into the pot chucks of the grinder and is recessed for both a metal disk roughing tool and an abrasive wheel-finishing or "master" tool. Both dressers may be bolted to the base simultaneously or each may be used alone, according to the requirements of the work. When equipped with the finishing tool the unit is said to produce work equal to that of a diamond, and at the same time permits considerably faster traversing of the wheel and deeper cuts into the loaded surface without harm to the dresser than would be possible with a diamond.

The wheel of the dresser is set at a 10-deg. "shearing angle" when bolted to the bar. The roughing tool may be used as a preliminary to finish truing or entirely for certain work requiring a radius of not less than $\frac{3}{32}$ in. In either case, a considerable saving over diamond truing costs is claimed.

Another feature given emphasis by the makers is light weight. The unit equipped complete with a master tool



Ross Wheel-Truing Unit for Landis Hydraulic Crankpin Grinders

Shop Equipment News

weighs approximately 35 lb., which is considerably less than the weight of the average crankshaft; hence quick application of the unit to the grinder is facilitated.

A pin in either end of the bar automatically gives correct alignment. The design and strength of the bar material are said to insure the required rigidity for all conditions.

Barber-Colman Reamer Sharpener

BRIEF mention was made on page 488, Vol. 67, of the *American Machinist*, of the reamer sharpener recently developed by the Barber-Colman Co., Rockford, Ill. Details of construction of the unit are now available.

The base of the unit is of box-type construction, with cross ribs for rigidity. Between these sections are openings for housing the motor, the tool compartment for change gears and attachments, and the apron carrying the table-oscillating mechanism. The base has a three-point bearing on the floor to eliminate vibration.

A 2-hp. motor running at 1,150 r.p.m. supplies power for operation. This motor is set on a sub-plate and drives an extended shaft carrying the drive pulleys for the wheel spindle and the platen drive. Idler pulleys are provided for maintaining the proper tension on the short drives necessary.

The platen drive shaft is provided with a cone clutch, mounted on separate bearings, and a worm. The clutch is engaged by a large centrifugal spring, and is released by sliding the entire drive shaft. This movement is controlled by means of a multiple-thread screw and a lever mounted on the front of the machine convenient to the operator. With this construction, it is possible to control the starting and stopping of the platen within $\frac{1}{8}$ in. of the desired position for setting.

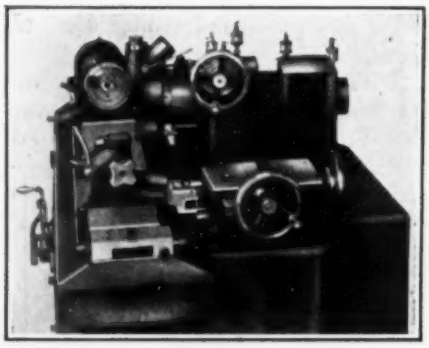


Fig. 1—Top view of Barber-Colman Reamer Sharpener showing the main and auxiliary platens

Mounted on the main platen is an auxiliary platen pivoted at one end, so that it can follow the form of a cam at the other end through the medium of a hardened and ground follower finger. In Fig. 1, the position of the auxiliary platen in relation to the main platen is shown. The traversing motion of the platen is controlled by a drum-type cam located at the center of the machine. This cam is used to reverse the motion for grinding right- or left-hand spiral reamers. The camshaft carries a wormwheel, which is driven from the worm on the drive shaft. Universal joints with a telescoping shaft provide the connection between the camshaft and change gear box.

A gear box mounted on the end of the auxiliary swivel platen provides for automatic indexing. The main platen or slide has one V-slide and

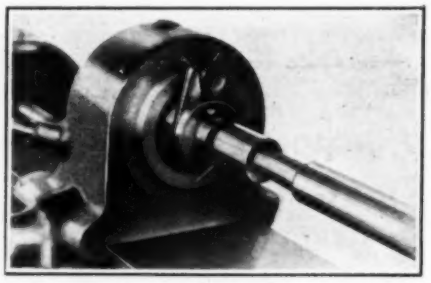


Fig. 2—Driving dog arrangement on the headstock

one flat slide to assure accurate guidance. This platen is cored to reduce its weight, but is sufficiently cross ribbed to maintain rigidity.

The headstock is gear driven through a spline shaft connected with the feed change-gear box. By means of a sleeve-gear construction, the use of a dead center is possible, with the work driven by a dog. The head is also provided with a specal driver for determining definite cutting and release angles, so that it is unnecessary to make a special setting for each angle. The tailstock, with spring tension on the center and quick release to remove the work, is of the conventional type for grinding. Fig. 2 shows

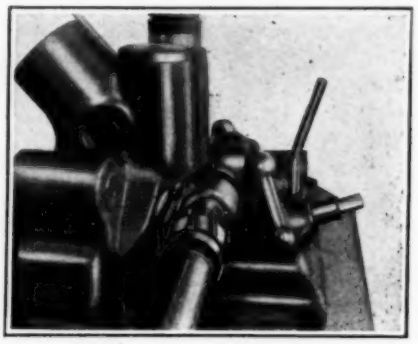


Fig. 3—The tailstock with a reamer in position for grinding

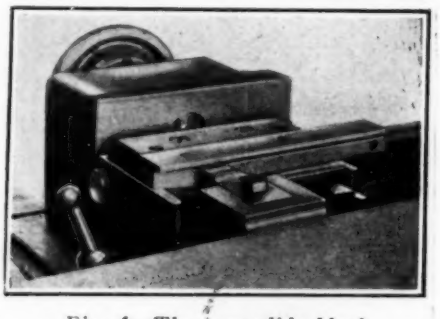


Fig. 4—The cam slide block

how the reamer is driven from the headstock, while Fig. 3 illustrates the tailstock as well as the position of the reamer in relation to the setting gage and the grinding wheel. The finger shown is moved out of position after setting, and is not used to guide the blades.

In Fig. 4 the cam slide block is shown mounted on the base at the free end of the auxiliary platen. Two slides are provided, one to permit the grinding of back taper as required, and the other to vary the length of bevel on the end of the reamer while grinding, without the necessity of changing clearances of form of nose. This cam slide block is also provided with a trip release mechanism for taking the work out of its path on the return stroke, and for grinding either right- or left-hand reamers.

There are four interchangeable nose-beveling cams that permit the grinding of reamers for through holes and bottom holes, and for hand and cylinder reaming. Special cams can be supplied for any reasonable form required on special reamers.

The grinding wheel spindle is of plain-bearing construction throughout, and is mounted in a sleeve with a special end-thrust mechanism, making it possible to grind reamer diameters to close limits. This end-thrust mechanism, together with the plain bearing

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construction, lends itself to the correction of end-play.

The in-feed of the spindle is accomplished through rack teeth in the sleeve and a pinion driven through a worm and wheel, so that accurate control is possible. The driving pulley for the spindle is mounted on separate bearings in order to relieve the spindle of the belt tension. The driving connection is made through a universal-jointed shaft.

The grinding wheel is 4 in. in diam., and is of the straight cup type. It is carefully balanced and trued to avoid all vibration. The same wheel can be used for taking both rough or finishing cuts, but its primary purpose is for sharpening. The guard over the wheel is made of cast-iron and is provided with a diamond for dressing the wheel. This can be done while the work is in position.

The net weight of the reamer sharpener is 4,000 lb. approximately.

McCrosky Improved "Neva-Stop" Faceplate

As in the earlier model made by the McCrosky Tool Corporation, Meadville, Pa., the purpose of the improved "Neva-Stop" faceplate is to enable an engine lathe operator to change work, being handled on centers, without stopping his machine. In Fig. 1 the complete unit is shown.

In place of only two driving jaws the improved Neva-Stop faceplate has three, as shown in the disassembled view, Fig. 2. In this improved design a surer and better distribution of the driving power is attained than was possible with the earlier two-jaw design. The body of the faceplate is now made from a solid steel disk, and the front plate and guide plate have been materially strengthened. All wearing parts are hardened. The jaws are made from special drop-forged alloy steel and are hardened.

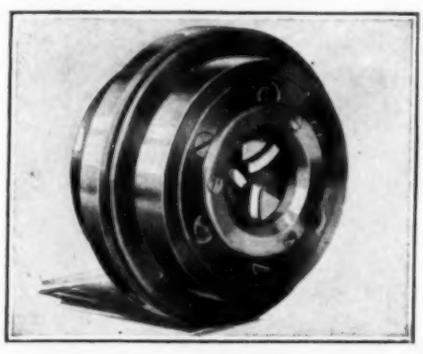


Fig. 1—McCrosky Improved "Neva-Stop" Faceplate

In operation the Neva-Stop faceplate is screwed on the lathe spindle and the work is gripped and driven by serrated jaws. These jaws are brought into contact with the work

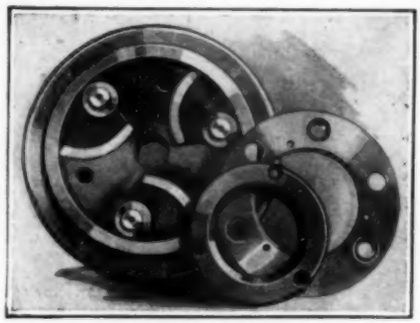


Fig. 2—A disassembled view of the Faceplate

by springs, but the driving pressure is secured by the camming action of the jaws. The greater the resistance there is to turning, the more holding power there is developed.

To release the work the operator applies slight resistance on the outside collar of the revolving faceplate. This action automatically opens the cam jaws and holds them open. A new piece can then be placed on centers while the spindle is turning. When the operator touches a trip located in the collar the jaws are instantly released and begin to drive the work.

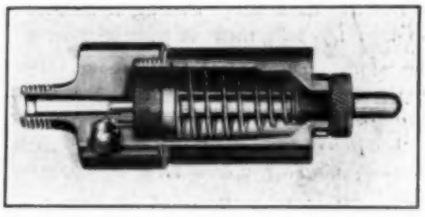
The improved faceplate can also be furnished with a plain wide collar in place of the collar having a trip. The plain type is operated by a single friction brake, which can be made in the shop of the user from drawings furnished by the manufacturer. To apply the brake the operator steps on a treadle. This brake provides the necessary friction on the collar to open the jaws and hold them open. When a new piece has been put on centers, the jaws engage the work as soon as the brake is released. This arrangement increases the speed with which the work can be changed without stopping the lathe and is particularly recommended where one operator is in charge of more than one machine.

Although the jaws of this Neva-Stop faceplate are designed primarily for driving work that is concentric and symmetrical, they will also adjust themselves to drive work that is slightly out of round.

The faceplate is $8\frac{3}{8}$ in. in diameter over all, and the mount or body portion is $6\frac{3}{8}$ in. in diameter. It is left blank so that it can be bored out and threaded to fit the spindle of the particular lathe on which it is to be used. It is furnished with two sets of jaws, handling work from $\frac{3}{8}$ to $2\frac{1}{2}$ in. in diameter. Jaws to handle larger diameters can be furnished on special order.

"Dot-O-Matic" Pressure Grease Cup

A spring-actuated pressure grease cup incorporating a special feature by which it is claimed that a uniform flow of lubricant is maintained despite the constantly lessening pressure of the spring as the cup is emptied, has been brought out by the Dot Lubrication Division of the Carr Fastener Co., 31 Ames St., Cambridge, Mass. The cup is applicable to any bearing upon which a light grease may be used as a lubricant. By adapting the consistency of the grease to the conditions, the cup is claimed to render satisfactory service in exposed places at low temperatures,



"Dot-O-Matic" Pressure Grease Cup

or, covered by a special dust-guard, to be equally efficient in flour mills, cement mills and other places where dust is likely to collect.

The cup consists of a shell, made in two parts, in which there is a chamber to hold the grease; a spring-actuated plunger working within the chamber to expel the grease; a tapered stem extending through the opening by which grease is delivered to the bearing; and a "Dot" nipple through which the chamber is filled by means of a grease-gun.

The plunger is composed of a leather cup-washer surrounding a metal center, from which a stem extends in both directions; upward, to pass through the end wall of the chamber, and downward, to fill par-

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tially the outlet through which the grease escapes. A conical-spiral spring surrounds the stem above the plunger to apply pressure necessary to expel the grease to the bearing. In the form of cup here shown the upper stem is surrounded by an annular adjusting nut by which the pressure of the spring may be regulated. The cup is also made without this adjusting feature.

That part of the stem below the plunger is tapered, with the smallest diameter toward the plunger. Thus, when the chamber is filled with grease and the spring is at its greatest degree of compression the largest diameter of the stem nearly fills the outlet and restricts the orifice to a very narrow annular opening. As the spring pressure gradually decreases because of the slow descent of the plunger the capacity of the orifice available for the escape of grease automatically increases by reason of the diminishing diameter of the stem in the opening.

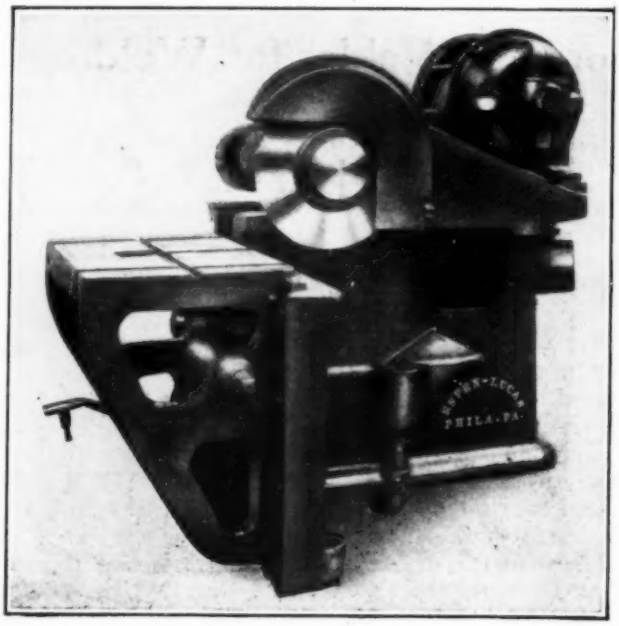
The upper part of the stem extending through the end wall of the chamber constitutes an indicator to show by casual observation the amount of grease remaining in the cup. When the cross-hole in the stem disappears within the bore of the adjusting nut it is time to refill. Filling is accomplished by attaching a grease gun to the "Dot" nipple. A ball check-valve in the nipple retains the grease in the cup when the gun is removed.

To prevent overfilling the cup and thereby causing the spring to become "set," there is a shoulder in the bore of the chamber that prevents the plunger from rising too high.

The cup is now made in sizes of 1- and 2-oz. capacity, and a 4-in. size is under construction.

Espen-Lucas Semi-Automatic General-Purpose Sawing Machine

This semi-automatic general-purpose sawing machine made by the Espen-Lucas Machine Works, Philadelphia, Pa., was designed especially for sawing busbars up to 8x¾ in. of either copper, bronze or brass, and tubes and extruded shapes up to 4 in. in diameter. Small bars and tubes may be held and cut off in multiple. The maximum feed is 2 in. per second.



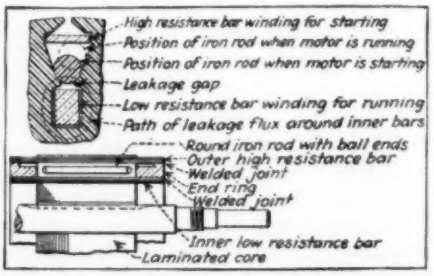
Espen-Lucas Semi-Automatic General-Purpose Sawing Machine

The work table is vertically adjustable for holding different sizes and shapes on or near the center of the saw arbor. The platen is arranged for the attachment of air- or mechanically-operated fixtures, straightedges and the like. Operation is by foot treadle at the front of the machine on the left. Upon depression of the treadle, the saw blade is fed automatically forward and automatically quick returned to the starting position upon completion of the stroke. The movement of the saw carriage is provided by an Espen-Lucas low-pressure oil pump.

Fairbanks-Morse Variable-Leakage, Double Squirrel-Cage Motor

A recent development of Fairbanks, Morse & Co., Chicago, Ill., is a variable-leakage, double squirrel-cage motor that features low starting current with good running characteristics. The accompanying illustration shows a section through the rotor slot.

In this type of motor the current in the inner winding at starting is choked by means of movable iron rods. These rods are placed in each rotor slot between the inner and outer squirrel-cage bars. The instant the motor is connected to the line, the iron rods are pulled down toward the inner bars, thus closing the small magnetic leakage gap in the rotor iron. In this way a complete iron circuit for magnetic flux is formed around each inner bar, thus completely choking the current in the inner, low-resistance winding. This choking action on the inner winding forces almost all of the current to flow in the outer high-resistance winding at the start and in this way produces a high starting torque with a low starting current. As the rotor accelerates the iron rods are thrown out of the leakage gaps by centrifugal force. This action removes the choking effects from the inner winding when the motor is running, and results in a much better running performance than would otherwise be possible with a double squirrel-cage motor. It is also possible to use much higher resistance in the outer winding when exceptionally low starting current is desired, and where the starting torque requirements are moderate.


High resistance bar winding for starting
Position of iron rod when motor is running
Position of iron rod when motor is starting
Leakage gap
Low resistance bar winding for running
Path of leakage flux around inner bars
Round iron rod with ball ends
Outer high resistance bar
Welded joint
End ring
Welded joint
Inner low resistance bar
Laminated core

Cross-sectional view of Fairbanks-Morse Variable-Leakage, Double Squirrel-Cage Rotor

At starting there is a slight noise due to the rods changing position, but since this change is practically instantaneous the noise should not be objectionable.

These squirrel-cage motors are furnished with ball bearings. Among the advantages claimed are: maintenance of uniform air gap; ability to carry the belt pull without failure; long life without attention, and high mechanical efficiency.

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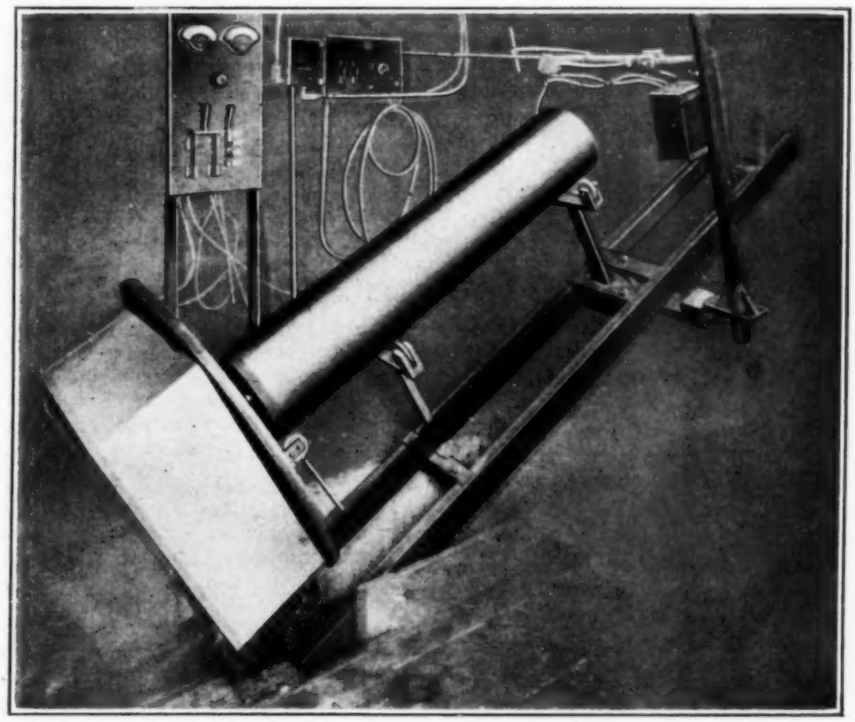
Lincoln Automatic Welder for Welding Heads in Range Boilers

IN THE illustration is shown in actual operation a "Stable-Arc" automatic welding machine made by the Lincoln Electric Co., Cleveland, Ohio, for the purpose of welding the heads in range boilers.

The tank is mounted on a rotating table in an inclined position. This table is driven by a small variable-speed motor which provides speed adjustment for tanks of various diameters. Roller rests are provided to maintain the alignment of the work. The carbon electrode is carried by an adjustable arm supported from a rigid pedestal on which the motor starter is mounted.

No filler metal is required in this operation since the head is flanged and is inserted so that a lap joint is secured as in a riveted tank. The heat of the arc melts the edge of the lap of the cylindrical sheets, thus fusing it with the head and forming a solid, leak-proof joint. On 14-gage material, seams have been welded at the rate of 135 feet per hour.

While these machines were developed primarily for welding range boilers, they are equally applicable for welding all kinds of small cylindrical tanks. This is one of the three automatic machines used in making cylindrical tanks. The first machine, described on page 213, Vol. 67, of the *American Machinist*, welds the seams while the second, described on page 365, welds the bottom into the tank. With the addition of this last unit the entire tank can now be made without hand welding of any kind being necessary.



Lincoln Automatic Welding Machine for Welding Heads in Range Boilers

Trade Catalogs

AUTOMATIC CONTROL. The Brown Instrument Co., Philadelphia, Pa., has published an illustrated leaflet showing the application of automatic control to all kinds of industrial manufacture, including oil refining, spring making, die casting, galvanizing, tempering, enameling, electrotyping, japanning and preserving.

BEAM SECTIONS. The Carnegie Steel Co., Pittsburgh, Pa., has published the first edition of additional sizes of the new series of beam sections. Profiles, properties and safe loads for structural beams and column sections are given. The material is presented in tabular form.

CHAIN HOISTS. The Dickerman Hoist Mfg. Co., Cleveland, Ohio, recently published a leaflet on its "Ideal" spur-geared, ball-bearing chain hoists. The construction of the hoist is explained with the aid of an exploded view. Specifications and price lists are given.

CONTROLLERS. The Allen-Bradley Co., Milwaukee, Wis., has issued a series of loose-leaf inserts for bringing its catalog up to date. The bulletins cover controlling rheostats, semi-automatic resistance starters, slip-ring motor starter, a.c. contactor, a.c. reversing switch, across-the-line starting switch, and automatic slip-ring motor starter. Each insert is well illustrated and treats in a technical manner the electrical characteristics of the equipment. Revised price lists are also supplied in each case.

COUNTERBORES. The Gairing Tool Co., Detroit, Mich., in a booklet entitled "Engineering Reference," describes briefly four different and distinctive types of counterbores together with an interchangeable type of core drill, multiple-operation cutters and other end-cutting tools. The text is illustrated with large-sized line drawings and photographs in a pleasing style. The publication contains sixteen 8½x11-in. pages.

FORGES, GAS. The American Gas Furnace Co., Elizabeth, N. J., has issued bulletin 3A on its gas forges. These include the bench and floor-stand types, rivet heaters, glass-bending forges and special forges for miscellaneous operations. A foreword discusses the general principles of heating by gas. The publication contains twelve 8½x11-in. pages and is perforated for insertion in a loose-leaf binder. It is well illustrated throughout with photographs.

HEATING UNITS. The American Blower Co., Detroit, Mich., describes in a pamphlet the method of unit heating as applied in the new Oakland-Pontiac plant. In addition details and specifications of the unit are given. The publication is well illustrated throughout.

HEAT-TREATING EQUIPMENT. The Chicago Flexible Shaft Co., 5600 Roosevelt Road, Chicago, Ill., has issued an illustrated leaflet on the Stewart heat-treating furnaces. Among the furnaces described are tool-hardening and heat-treating furnaces, oven or semi-muffle furnaces, carburizing and annealing furnaces. The leaflet is illustrated with photographs.

MAGNETS. The Liberty Engineering Co., 34 Balmforth Ave., Danbury, Conn., describes in a small leaflet the Liberty universal "Magnet" for magnetizing and de-magnetizing small steel parts. The apparatus is described and its operation explained. The bulletin is illustrated.

MILLING MACHINES. The Ingersoll Milling Machine Co., Rockford, Ill., has published bulletin No. 47 on its product. This publication contains forty 8½x11-in. pages and is profusely illustrated throughout with photographs. Adjustable-rail milling machines, both the standard and heavy patterns, are described and several sizes are illustrated, some of them in operation on actual production jobs. Open-side milling and boring machines, keyway milling machines, continuous milling machines and special boring and drilling machines are among the units described. A section is also devoted to inserted-tooth cutters.

MOTORS. The Louis Allis Co., Milwaukee, Wis., has issued bulletin 500 on its multi-speed squirrel cage a.c. motors. The publication contains sixteen pages and is perforated for insertion in a loose-leaf binder. The chief characteristics of the motor are first pointed out with the aid of photographs followed by a summary of specifications together with a table of ratings. The remainder of the pamphlet is devoted to the illustration of various applications of this type of motor in all kinds of industrial drives.

MOTORS, SPLIT-PHASE. The Wagner Electric Corporation, St. Louis, Mo., describes in bulletin 153 its type 58RB split-phase induction motors of fractional horsepower. The construction and operation of this type of motor are discussed in considerable detail, aided by views of the various parts.

PLATFORMS. The Youngstown Pressed Steel Co., Warren, Ohio, in an attractively jacketed bulletin, describes the YPS corrugated pressed-steel platform. It is pointed out how these platforms can be made to fulfill many industrial requirements in connection with hauling and storing of parts.

PRECISION GRINDING. The Wisconsin Electric Co., Racine, Wis., puts in a plea for precision manufacture in an interesting little booklet bearing the caption "One Ten Thousandth of an Inch." The origin and development of interchangeable parts manufacture are first traced and fits and tolerances are discussed. The treatment is largely technical in character. Two pages are devoted to describing the Dumore grinders made by this company.

PRESSED STEEL PARTS. The Youngstown Pressed Steel Co., Warren, Ohio, presents the case of pressing versus casting in an interesting little pamphlet entitled "Adventures in Redesign." About fifteen actual examples are cited where considerable money was saved on the cost of the product. The treatment is technical in character, but it is written in semi-popular style. Many illustrations are used to enhance the text.

PYROMETER, OPTICAL. The Pyrometer Instrument Co., 74 Reade St., New York, N. Y., has issued an eight-page leaflet describing the simplified "Pyro" optical pyrometers. This radiation type of instrument is used for measuring the temperature of small glowing bodies, not inclosed and not having the characteristics of a black body, and for determining the temperature of pouring metal. A complete technical description of the construction and operation of the unit is given.

REAMERS. The Morse Twist Drill and Machine Co., New Bedford, Mass., describes a new line of expanding chucking reamers in a small illustrated leaflet, recently issued. Specifications and prices for both straight- and taper-shank types are given.

SAWS, METAL-CUTTING. Henry G. Thompson & Son Co., New Haven, Conn., has issued a small illustrated catalog on the line of metal-cutting saws. This line includes the "Milford" brand of hack saws, and band saws of various types for a wide variety of application.

SPEED REDUCERS, HERRINGBONE. The D. O. James Manufacturing Co., 1120 W. Monroe St., Chicago, Ill., has published catalog No. 133 on its generated continuous-tooth herringbone-gear speed reducers. This catalog contains 48 8x10½-in. pages. The evolution of herringbone gears is first traced and then the particular features of the James type of gear are pointed out. Various features of the drive are also described. Many pages are devoted to specifications and horsepower ratings. Several applications of the drive are shown. The catalog also contains information on straight-line speed reducers and worm-gear speed reducers. It is illustrated.

TRANSMISSION MACHINERY. Winfield H. Smith, Inc., Springville, Erie County, N. Y., has issued a new 16-page circular fully describing the line of light power transmission machinery. The illustrations in the circular show speed reducing gears, hangers, pillow blocks and other equipment for use in installations of small horsepower capacity.

TURRET LATHE TOOLING. The Jones & Lamson Machine Co., Springfield, Vt., show, in a pamphlet recently issued, how chuck work can be handled with standard turret lathe tooling. The presentation is largely pictorial.

WESTINGHOUSE EQUIPMENT. The Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa., announces several leaflets describing its equipment. Bulletin 3907-C describes turbines for mechanical drive in capacities from 5 to 750 hp. Catalog No. 25 is on industrial heating apparatus, including box furnaces, lead and salt baths and pots, drawing baths, melting pots and miscellaneous equipment. Leaflet L-1868-B, covers more specifically an automatic electric melting pot made by this company.

WORM GEARING. The Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill., has issued catalog No. 400 on its "IXL Moderntype" worm gearing. In this publication, which is well illustrated throughout, the early evolution of worm gearing is first traced, showing particularly the influence of the automotive field of application. The development of IXL Moderntype worm gearing is then described. Uses and applications of this drive are presented and general engineering information governing the application of worm gearing and machine design are discussed. Specifications and ratings are also given.

Pamphlets Received

EMPLOYEE MAGAZINES. The Policyholders Service Bureau of the Metropolitan Life Insurance Co., 1 Madison Ave., New York, is publishing in pamphlet form some of the talks given at the Employee Magazine Editors Conferenve recently held in New York City. The title of pamphlet No. 2 is "How to Meet and Overcome the Problems of the New Employee Magazine." The talk was presented by Earle R. Lane of Spencer Trask & Company.

MACHINING OF LOW-CARBON, PLAIN AND ALLOY STEELS. The International Nickel Co., 67 Wall St., New York, N. Y., has available reprints of the article from the April issue of *Transactions of the American Society for Steel Treating*, entitled "Smooth Finish Machining of Low-Carbon Plain and Alloy Steels," by J. S. Varnick and T. H. Wickenden. There is given a practical explanation of shop practice for obtaining a smooth finish on such steels by avoiding the critical range in volume removal rate. Tables indicate the most satisfactory cutting speed at which the lathe should be operated.

SPRINGS. The Wallace Barnes Co., Bristol, Conn., has published the first number of a monthly house organ known as "The Mainspring." In it the company expects to give the spring users full and concrete information about the design, manufacture and use of springs. Subject matter for the house organ will be written by those within its own organization and by well-known authorities on springs. The treatment is to be technical in character and strictly educational in tone. Self advertising is to be avoided, according to the statement of the publishers. The first issue conforms to these claims.

WRENCH MARKINGS. J. H. Williams & Co., Buffalo, N. Y., have available for distribution, in leaflet form, a table of wrench opening sizes for U. S. and S. A. E. nuts and capscrews. In accordance with the recommendation of the American Engineering Standard Committee, wrenches are now marked with the width across the flat of the nut and they are designed to fit. Copies of the leaflet may be obtained from the company.

NEWS OF THE WEEK

Railroads Urged to Increase Freight Handling Equipment for 1928

A. B. Johnson warns against government ownership

AN APPEAL to the nation's railroads to increase their freight-hauling equipment and speed up generally the work of getting their rolling stock into first-class condition to meet an enormous business which is anticipated for 1928, has been made by Alba B. Johnson, president of the Railway Business Association.

In a letter to the members of the association from Mr. Johnson's offices in Philadelphia, he points out that in the first nine months of this year the tractive power of freight-carrying locomotives owned by Class 1 railroads, has declined, while the total capacity of freight cars has increased only one-quarter of one per cent. A traffic increase, he says, would wipe out the present equipment surplus.

Mr. Johnson, who is a former president of the Baldwin Locomotive Works and now president of the Pennsylvania State Chamber of Commerce, urges the carriers to obtain more equipment, get crippled locomotives out of the shops, bring about a more orderly control of cars and increase their capacity generally; or face some sort of government ownership, such as was advocated a few years ago in the proposed "Plumb Plan" for control of the carriers.

"A serious situation seems to have developed in respect to Class 1 railway equipment as reflected in the report of the car service division of the American Railway Association, published Oct. 26, covering nine months to Oct. 1," Mr. Johnson's letter relates. "As has been usual, the installation of locomotives and cars were fewer than the retirements; but wherever as heretofore through enlargement of units the total power and car capacity have constantly increased, the turn has come: The freight locomotive increments and modernizations since Jan. 1 were exceeded by retirements measured in tractive pounds of effort.

In detail:

Freight Locomotives	Pounds
Total tractive power Jan. 1	1,842,992,000
Total tractive power Oct. 1	1,824,180,000
Reduction nine months	18,812,000
Freight Cars	**Tons**
Total capacity, Jan. 1	105,704,000
Total capacity, Oct. 1	105,968,000
Increase in nine months	264,000

"Apart from the anxiety which all concerned should feel over transport preparedness at any normal time, are we not confronted with a probable traffic emergency in 1928? I allude to the strengthened buying power of the farmers and the impending resumption of low-priced automobile manufacture now held back for a demonstration of the new Ford model.

One Million Buyers

Discussing the prospective increase in business for next year Mr. Johnson refers to the Oct. 26 bulletin of the Department of Agriculture, indicating enlarged purchasing power of farm districts. He believes that when the new Ford car has been sufficiently tested in use on the road, one million buyers, now waiting, will order either a Ford car or some other make.

"This will greatly benefit the oil industry, the plants fabricating car parts, or materials, and all the industries dealing in shelter, furniture, food, clothing and luxuries, whose business expands from resumption in any occupation so vast as agriculture or the automotive industry," he adds.

"Manufacturing insolvencies are still showing the strain of low margins of profit aggravated by reduced volume. With relief in the form of increased business this should be improved.

"For our railways to cope successfully with this emergency is of prime consequence to their owners and managers as well as to the public. When the railroads were returned in 1920, the paramount responsibility of management was to demonstrate that private ownership could satisfactorily serve the public. Only so could they permanently discourage efforts toward another Federal seizure. They have done it. Never was there so little criticism. Is it certain that this gratifying condition can continue in case of traffic increase substantially larger than we have seen of late?

"Evidently 1928 will bring a severe test. At each juncture from now on the preservation of private ownership will be a struggle between satisfactory service on the one hand and the Plumb Plan or other government ownership propaganda on the other."

Co-ordinate Operating Companies Under Manning, Maxwell & Moore Control

C. A. Moore, Jr. heads reorganization

In order to co-ordinate the handling of their business, Manning, Maxwell & Moore, Inc., of New York, have organized two operating companies under the laws of Delaware. They are the Consolidated-Ashcroft-Hancock Co. and the Shaw Crane-Putnam Machine Co. Manning, Maxwell & Moore, Inc., owns all the stock of both corporations.

The Bridgeport and the Boston plants of Manning, Maxwell & Moore, Inc., and the sales force marketing the products of these plants will make up the Consolidated-Ashcroft-Hancock Co. The Shaw Crane-Putnam Machine Co. takes over the Shaw Crane Works and the Putnam Machine Works and the sales activities pertaining to them. The supplies department and the Chicago machinery branch office of Manning, Maxwell & Moore, Inc., operate as they have formerly.

This arrangement has been made after consideration of the diverse and unrelated parts of the business of Manning, Maxwell & Moore, Inc. The board of directors and the officers expect satisfactory results from this adjustment of operations.

The present officers of Manning, Maxwell & Moore, Inc., are: C. A. Moore, Jr., president; H. D. Carlton, vice-president; E. M. Moore, vice-president; F. J. Baumis, vice-president; J. D. Nicklis, vice-president; F. W. Knowles, comptroller; F. M. Kreiner, secretary and treasurer.

The officers of the Shaw Crane-Putnam Machine Co., Inc., are: C. A. Moore, Jr., chairman, board of directors; F. J. Baumis, president; F. W. Knowles, vice-president and comptroller; F. M. Kreiner, secretary and treasurer; E. L. Fickett, assistant to president.

The officers of the Consolidated-Ashcroft-Hancock Co., Inc., are: C. A. Moore, Jr., chairman, board of directors; H. D. Carlton, president; W. H. Williston, vice-president; C. H. Graesser, vice-president; F. M. Kreiner, secretary and treasurer; F. W. Knowles, comptroller.

Political and Financial Uncertainties Still Hamper French Industry

Automobile production growing in importance

By Our Paris Correspondent

THE political situation is uncertain. Monsieur Poincaré won his battle for the 1928 budget with the finance commission but it still has to come before parliament for final ratification. A general election is but five months away and there is a possibility of a strong Radical - Socialist government as the future party in power, with a complete turn-about-face in prospect on many economic questions, beginning with taxation and perhaps going so far as the tariff. The latter situation, if it comes about, will help the Franco-American tariff situation.

American tools and machinery, indeed all manufactures of metal, are bound to feel the burden of the new French tariff charge which in certain instances is four times what it was before the new trade accord was granted Germany, and in all cases heavier than that borne by similar German-made products entering France. Of the ethics of the question little need be said, but the situation has become doubly embarrassing to France by reason of the fact that she has a delegate sitting on the tariff commission of the League of Nations, an aftermath of the Economic Conference of last summer, where it was recommended that prohibition and restrictions of import and export should be abolished and a leveling of tariffs all round for a freer intercommunication of trade without discrimination. America's delegate sits and looks on without vote, but the best minds of Britain, France and Germany are seeking the means to increase trade with each other and the smaller powers.

It may be taken for granted that production in many general lines is in excess of that of last year at this time and, in general, it is in excess of demands. Price adjustment cannot be expected to stimulate trade within the country any more than combinations and cartels can make trade where it does not exist.

Prices Are Favorable

Consumers may be assured that price conditions are about as favorable as they are likely to be and that only a revalorizing of the franc can help them otherwise. This is something which is not likely to materialize with the parliamentary battle on the budget for 1928 in immediate prospect, and the electoral battle of the forces which are lining up for next spring's mass attack against the Poincaré financial program. An improved franc will help American exports to France as it will help imports from other high exchange countries; a franc stabilized at the present figure will help French trade abroad. The decision as to the road to be followed will be the chief issue of the French government as soon as pressing affairs are out of the way.

Salaries in the metal transforming trades—machinery, automobiles, electric appliances, etc.—in the Paris district now work out at 3.22 francs per hour on the weekly wage scale, and 3.43 francs as based on piecework. An English writer in the *Financial Times* (London) states that these figures represent but one-half of the corresponding wage scale of the British worker.

The opinion advanced by the report of the French Association of Metal and Machinery Trades is to the effect that French production costs of today can not be reduced greatly under any more intensive operation. This is due to the fact that overhead and labor are charges which may not be compressed, above all as no taxation relief is to be looked for in 1928, either with respect to turn-over or profit taxes—two loads which bear heavily on the industrial proprietor, not on the worker.

Foreign Trade Unsatisfactory

Foreign trade balances for the first nine months, as compared with 1926, show valuations not wholly satisfactory. Imported materials necessary for industry fell off 6,246,375,000 francs; and exports of manufactured goods took a drop of 3,077,317,000 francs. Importations of foodstuffs on the other hand increased 2,147,243,000 francs. Logically, the showing is not favorable. Owing to the improved value of the franc as compared with its last year's status, the situation is not so unsatisfactory as it might be made to appear but the imports of raw materials for industry and the slowdown of production of the past three months or more are indications that ground already gained in foreign markets is being lost.

The greatest automobile show ever held in Paris has just closed its doors. French exhibits were in the lead but only half a dozen of the big names in the small car field suggest any possible great activities here in the industry in the near future. Next in line came the United States with twenty-three individual exhibits, with a popular six-cylinder model (duty paid) selling at but little more than its only real French competitor and offering more for the money at that. Quantity output, more rational production methods and a big home market are, of course, the explanations which European industry advances for American supremacy which is why, it is admitted, that such conditions can never be met in France.

When the tariff crisis is finally cleared up a real battle will be on, though Alfred P. Sloan, Jr., of General Motors, said at the auto trade banquet at the closing of the show, that he "congratulated the French industry on the excellent technical and artistic progress which had been made." He also said that America owed much to France in the motor vehicle line.

French automobile prices are not being reduced. The Citroen model which has been popular for some time actually carries a list of a thousand francs more than last year, while German makers are announcing a general drop of 10 per cent all along the line.

A stand at the show which was of special significance was that devoted to the normalization or standardization of automobile parts, showing the French manufacturer, to say nothing of the worker and the general public, its manifest, almost necessary, advantages if further absorption of motor vehicles in France is to be looked for on any great scale. The French automobile and allied industries employ 450,000 workers, practically a quarter of the labor of the entire metal industries.

The machinery trade is dull though prices have been cut in some lines in order to stimulate business. Small wood and metal working tools are quiet.

French manufacturers are attempting to produce American type saws and saw blades and have made some progress with tungsten steels. The tariff difficulty is giving French makers a chance to rush the market, if it should be proven that they are equal to it, in price perhaps, if not in quality.

France Underbid

The steel stamping and building hardware trades are active. An important contract for construction steel and accessory elements for Bulgaria was bid at 13.34 *leva* the kilo by French makers, 10.62 *leva* by German makers, and 10.60 *leva* by those of Belgium. If the scale of comparison on other fabricated metal lines holds good it would seem to show that French prices are 30 per cent above those of Germany and Belgium in European export markets.

Railway motive power and rolling stock business depends upon the development of the programs of the big lines. The activities of the Midi Railway are the most notable. Orders are to be placed at once for 130 electric locomotives with French makers while 30 will be given to Germany to apply on reparations account. Orders for over two hundred narrow gage freight cars for the State Railways of Algeria have been placed with French builders.

Bolt and nut makers have some business in hand but no large tonnage. Lathe turned specialties in series are in demand. Iron castings, as per models furnished, indicate a foundry activity better than in some months. The Foundry Syndicate, basing its report on labor figures, states, however, that the trade is less active than in September, 1926, or April, 1927. Steel foundries are working under a greater pressure. Fine steel sheets for the automobile industry are in chaos as to price and classification and it may be inferred that stampings of such material can be had of the self-contained steel plants more favorably than the semi-raw material can be worked up in the automobile plants themselves.

British Steel Firms Announce Merger

A foreign news dispatch gives the information that a working agreement has been reached between two great steel companies, Vickers, Ltd., and Armstrong, Whitworth and Company.

The agreement provides for the amalgamation of a portion of their businesses, principally in regard to naval shipbuilding and the manufacture of heavy steel armaments. The present capital of Vickers stands at £26,500,000, while the capital of the other company is about £11,000,000. A new company will be formed to take over the amalgamated businesses.

Great importance is attached to this move because it falls in line with the present trend of key industries to eliminate internal competition in order to work more successfully against foreign competition.

Employment Conditions Generally Better

In order more accurately to gage the business outlook, the United States Employment Service has conducted a special survey regarding present employment conditions and the prospects for the rest of the year. Analysis of the detailed statement, state by state, reveals that there is a prospect of some general increase in employment after balancing the effects of seasonal changes. The expected increase is not more than, if as much as, what could be expected to take place under conditions that are ordinarily present during the last three months of the year. The employment figures of the National Industrial Conference Board show that the seasonal upturn began later this year than in either 1924, 1925, or 1926. In each of these three years there was an increase in employment between July and August, whereas this year, there was a decrease from July to August.

A majority of the reports from the several states indicates that there is likely to be a surplus of unskilled labor during the remainder of 1927, resulting from the lessening of building activities, road concessions, canning, and farm operations which will not be absorbed by the increase in demand for factory labor.

Taking the country as a whole, prospects for increased employment are most promising in the New England States. The reports of these states, in many cases, are positive in their assertion that the outlook for a considerable increase in employment is good. In the farming states west of the Mississippi River, the outlook is influenced largely by the prospects of a good demand for farm labor during the crop season. In most of the remaining states, employment conditions are described as generally satisfactory. Very little change is anticipated, some improvement is expected.

Of the individual industries, the greatest improvement is expected in the textile industry. In the reports of 15 states where textiles are specifically mentioned, definite prospects for substantial increase in employment were insured. The prospects were also good for increased employment in the boot and shoe industry. Some increases were expected in the automobile, metal trades, and agricultural machinery industries, but the extent of the increases were not expected to be very great. For the iron, steel, and rubber industries, excepting rubber shoes, the reports were confined to statements indicating that there is not much change in employment in evidence now, and though some increases are expected later, no definite indications are at hand to bear out this view.

Westinghouse Promotes District Managers

J. S. Tritle, general manager of the merchandising department of the Westinghouse Electric and Manufacturing Company, has just announced the consolidation of several merchandising territories and the appointment of executives to be in direct charge of operations in these sections.

M. C. Morrow has been appointed sales manager of the merchandising department. F. R. Kohnstamm has been appointed his assistant.

The territory comprising the Northeastern Sales Section and the Philadelphia District has been consolidated with respect to merchandising and will be known as the Northeastern Merchandising District. George T. Kunklin is appointed district merchandising distribution manager of this territory, with headquarters in New York.

George Bailey, who has been assistant to the general manager of the merchandising department, is appointed district merchandising distribution manager at San Francisco of the territory comprising the present San Francisco, Los Angeles and Seattle districts which have been consolidated as the Pacific Coast Merchandising District.

Rhoads Belting Has 225th Birthday

At the recent convention of its sales force the firm of J. E. Rhoads & Sons was presented with a beautiful loving cup in commemoration of the 225th anniversary of the founding of the Rhoads leather business in America. On the cup was inscribed the words—"Thru wisdom is a house built; and by understanding is it established."

The Rhoads Tannery was started in Penn's Woods, about ten miles from Philadelphia in 1702. The leather business had been established in England by at least one generation before that.

At the recent convention the first announcement was made to the men that all brands of Rhoads leather belting would henceforth be regularly made with waterproof cement and waterproof treatment.

Machine Tool Output in New England

New England's output of machine tools, under census figures of 1923, were valued at $40,183,000, a little less than a third or 29 per cent of the country's total production that year, according to an industrial survey conducted recently by the New England Council and the Department of Commerce.

More than 80 machine tool factories employing 13,316 persons are located in New England. Most of the tools are produced in Massachusetts, Connecticut, Rhode Island and Vermont. The average annual sales of each company are placed at $455,000.

Machine tools are considered in the survey as distinct from machinists' tools; the former include power-driven machines for cutting or shaping metal or for calking, riveting or driving screws, whereas machinists' tools comprise bending, boring, broaching and cutting-off machines, portable tools and presses and threading machines.

The average machine tool plant reported as having been in operation for 31 years. Only three concerns have been started since 1921. Nearly one-fifth of all these companies have made a change in management in the last seven years. Only one producer reported the operation of branch plants.

Labor costs are an important item. During 1925 they were 36.4 per cent of the total value of product. Yet incentive methods of wage payment are confined by the companies with which this survey is concerned, on the average, to only 10 per cent of the employees. Connecticut, with 27 per cent, reported the highest state average.

New Bombing Planes for Army Air Corps

The Keystone Aircraft Corporation of Bristol, Pa., has begun work on twenty-five bombing planes ordered by the government for the army. Edgar N. Gott, president, said they are designed to carry 2,000 lb. of bombs and five machine guns each, adding that the design was developed by the Keystone company's engineers at Bristol.

They will be the first produced under government plans for reequipment of the bombardment units of the Army Air Corps, and will be designated as the L B-5 A type. The ships will have a cruising radius of 6 hr. at an average speed of 100 m. per hour. Two machine guns will be mounted in the forward cockpit, two in the rear cockpit, and one tunnel gun is designed to shoot through apertures in the floor.

The planes will be powered by two Liberty motors, and the fuselage will provide room for a pilot, mechanic, machine gunner and bombardier. They will be sent to Langley Field, Va., and those now in use there will be sent to Kelly Field, Tex., for use of student fliers. Mr. Gott expects the first of the order to be delivered within sixty days.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

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IN BUSINESS as well as in medical diagnosis, conclusions must often be drawn from data that are meagre and may be inaccurate or irrelevant.

The conscientious student or physician will therefore be careful to verify his deductions by every method that science has provided, for there is always danger that he may mistake cause for effect or assume that influences that have become inoperative are still operative. This is particularly true of the organism called business. In studying its conditions and prospects we often confuse sequence with consequence, or take it for granted that the mill is being run with water that has passed.

Just now there are many who seem to think that the recent decline in the stock market is the precursor of a trade reaction. This is natural for it is tradition that the function of the Stock Exchange is to anticipate and discount rather than to follow.

But there are exceptions to all rules, and in the present instance easy money sustained security prices long after a business reaction was indubitably indicated by the statistics. Those who have followed this review closely will bear witness to the fact that it pointed out the imminence and the beginning of a commercial recession some months ago, and now that the predicted recession has come and is recognized, it may be a mistake to reckon upon its continuance.

Almost every daily newspaper in the United States devotes from one column to a page to a report of the New York stock market. There is no other institution except the national government that gets so much free advertising, and the psychological effect is profound. But even Stock Exchange sentiment cannot long thwart the natural expansion of American enterprise. The mean or average of business in the United States is in fact best described by a gradually ascending line which is crossed and recrossed by other short lines that record the intermediate fluctuations in the volume of trade. As these intermediate fluctuations rarely go more than 10 per cent above or below the mean, a change would seem to be indicated whenever the maximum is approached.

Therefore it is important to observe that in three of its statistical aspects the volume of business is more than 6 per cent under 1926. Railroad net earnings for September show a decrease of 6.53 per cent as compared with last year. Car loadings for the week ending Oct. 22 are 6½ per cent under the same week last year, and the Federal Reserve Bank of New York reports that the wholesale trade in its district for September 1927 was 8 per cent under September, 1926.

WHAT'S DOING IN INDUSTRY

THE FIRST ten days of November have been moderately active in most large industrial centers. Sales of machinery and machine tools are progressing satisfactorily and there is a better outlook now than there has been in several weeks past. There is little hope for the closing of large lists but there is a healthy volume of small orders.

DETROIT reports a quiet but noticeable improvement, brought about by orders from automobile manufacturers. New bookings are moderately satisfactory in Milwaukee, and production of automatic machinery is being increased in the Cleveland district. General activity in Cincinnati is higher, both sales and inquiries showing an increase.

NEW ENGLAND business continues spotty, the Western section reporting increased activity in automatic machinery lines, but the Eastern district being hampered by depression in the textile industry. Buying in the New York market is holding to a fair volume. Activity in the Philadelphia district is up to expectations—which, however, were not great. Buffalo reports a decided change for the better in the machinery trade, with good prospects for November.

The information available with regard to the business in steel, automobiles, lumber, and textiles would appear to indicate an average reduction of about 10 per cent in their distribution, and as a generalization it is probably correct to say that the country's trade is not more than 90 per cent of what it was at this time in 1926.

Upon the basis of this generalization it seems safe to predict an improvement; for a greater decrease than 10 per cent is unlikely and could not last long without bringing about a prostration that is almost unthinkable to a nation whose wealth is as great as ours.

But the wrecks and rocks are always uncovered and visible at low tide, and while we are waiting for the flood that will succeed the ebb, it is likely that much will be heard of happenings that seem unfavorable.

Thus we read that the business failures for the ten months ending with October were the largest in the country's history since 1922, and that some of the cotton mills at Lowell, Mass., have reduced wages by 10 per cent with a view of ascertaining whether a widespread reduction would be accepted by the operatives.

It is also announced that "woolen and worsted mills long harassed by piecemeal buying will discontinue the manufacture of surplus stocks and confine their operations to the yardage required to fill orders." Other items that might be regarded as unfavorable include the receiver's report upon the condition of the Kansas City Joint Stock Land Bank, which seems to be in a bad way, and a decline of $1.25 in pig iron. But the important thing to remember is that insofar as present conditions are unfavorable they reflect the past rather than the future, and that they probably mark the ending of the ebb.

This is not to say that the decline in the stock market has been arrested or that the boom will be resumed. The unwarranted fear of a presidential election and the anxiety of brokers to reduce loans will probably keep speculators in a liquidating mood. Nor is any revival of commodity speculation to be expected. The grain markets are lethargic. Cotton is as usual waiting for the next government report. Sugar has been paralyzed by the far reaching control of prices and production that is proposed by the Cuban government. Coffee is also suffering from governmental interference with the law of supply and demand, and much the same thing is true of rubber. In these circumstances the speculators' opportunity is narrow, and merchants and manufacturers find the hand-to-mouth policy the safest.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

NEW YORK

A feature of the present market is the lack of inquiries that lead to immediate orders. Dealers and manufacturers' agents in this territory state that the orders which they are getting now are the result of personal solicitation on leads furnished by contact with industrial users who are in the market for high production equipment. Sales are holding up well and November is expected to at least equal October in total volume.

Railroad buying has tapered off to a few scattered orders for single tools. Little is heard in this locality from the automobile industry. Large electrical manufacturers are buying sparingly. Some recent business has been done with manufacturers of aircraft and aircraft motors. The Otis Elevator Company is reported in the market for a group of seven tools for its Yonkers Works. The Chicago & Northeastern R.R., a large shipbuilding concern, a technical school and a number of industrial plants were buyers in the past week. Another large machine tool builder announced a price advance last week, confirming the prediction that there would be a general advance in prices this fall.

CINCINNATI

In the Cincinnati district the majority of machine tool manufacturers report that in the past week sales showed a slight increase. Selling agents report that while their sales remained at about the same level as in the previous week they feel that a more active market is developing in the local territory.

Orders for single tools and replacements were the sustaining feature of the past week's market. The principal buyers were general machinists and miscellaneous users, but a few single orders were received from concerns in the automotive industry, from railroads and from the oil fields.

Manufacturers report the receipt of a number of inquiries in the week, coming from all sections of the country. The majority of these were for single tools and replacements.

Both manufacturers and the selling agents report that while a very large amount of business is pending, there is still a strong disposition on the part of prospective buyers to delay the matter of making purchases.

EASTERN NEW ENGLAND

An increase of 2 to 4 per cent in the machine tool and machine shop supply trade in Eastern New England is noted for the month of October. This, however, is tempered by the fact that October of 1926 shows an average considerably above the figures for October, 1927. On the other hand, October has gained over September of this year and dealers in this section are confident that business in November will be quite satisfactory.

Current volume has increased but consists mostly of small orders. According to representative houses in this section most inquiries have been by telephone, although inquiries by mail proved to be almost at a par with quotations by telephone. Conservative dealers in machine shop equipment are optimistic for business in November.

Owing to suspended or part-time operations in the textile industry, machinery demands for these concerns has shown a decided slump. Some of the larger mills have negotiated for factory sites in the South, and this has resulted in almost a dead level for textile machinery.

WESTERN NEW ENGLAND

Machine tool dealers in western New England are more optimistic. All state conclusively that October sales surpassed the September volume and that November will show even more substantial totals. Grinding and milling machines, automatic presses and screw machines are in good demand. Lathes and drills are next in demand. Small lists are in circulation for equipping automobile repair departments in several large garages, the aggregate construction valuation of which totals several hundred thousand dollars. These call principally for drills and lathes. The bulk of the demand for machine tools in this section is from novelty manufacturers and the automotive industry. Railroad companies are placing little business in this district.

Automatic screw machine production is increasing steadily, and plants producing novelties and small parts for the automobile industry anticipate overtime schedules shortly. Brass raw material manufacturers report full schedules, but the brass manufacturing divisions are only from 60 to 70 per cent of normal. The Crane Co. plant has reduced its working schedule to 32 hours per week.

DETROIT

The market for machinery and machine tools in Detroit is still undergoing a quiet but noticeable improvement. Orders are coming in from a number of sources and a large number of inquiries have been received within the past two weeks.

The Ford Motor Company has made a large number of fair sized purchases and it is generally believed that more will be made soon. Packard is buying and from all indications will continue to buy. Paige, Hupp, Cadillac and several other plants are sending in inquiries that point to substantial sales within the near future.

The Kelsey wheel plant is negotiating now for the purchase of large heat-treating furnaces. When this deal is consummated and some of the other large transactions are completed the general average of business here will be considerably higher than it has been during the past few months. Many of the small shops are busy. Employment figures have changed little within the past few weeks.

PHILADELPHIA

Some purchases of tools by general industrial firms for replacement purposes, and some inquiries for future buying, featured the machinery and machine tool market in Philadelphia during the last two weeks. While there was a lack of any evidence toward quantity buying, the situation on the whole was regarded as hopeful, and dealers and manufacturers look upon the future as bright.

Firms handling lathes, shapers and millers, others dealing in equipment for industrial buildings, and machine tools generally, reported the situation, while not as good as they had hoped for, on the whole was about what had been expected.

Evidence has accumulated that railroad companies will enter the market early next year. The opinion prevails that the carriers are marking time pending a settlement of some merger problems. Those who have watched the railroad situation believe there is little hope of any railroad buying during the remainder of 1927. Dealers and manufacturers who deal with general industrialists say their business is within 75 per cent of what they had anticipated early in the year.

MILWAUKEE

New bookings by manufacturers of metal working equipment continue moderately satisfactory and the first ten days of November have produced business virtually equal to expectations in a majority of cases. Inquiry is becoming increasingly active, although prospective buyers are still inclined to be slow about closing deals.

Automobile business, which has been relatively inactive for several months, gives promise of expansion. Immediate buying is confined to a few large interests, although many factories are making necessary replacements.

BUFFALO

Generally speaking, October was a good month in the machine tool and electrical equipment trade in this district. Earlier in the year the electrical equipment business was somewhat better than the machine tool trade. But current reports indicate that this situation is somewhat reversed for the first time this year.

There are two big contracts to be let within the next few weeks for electrical equipment in industry but the great volume of small sales and inquiries which really provide an index for buying trends is lacking. While there are some slackening signs, the machine tool trade reports are better. In most instances October was better than September.

Demand is dull in the contractors' equipment field. Purchases for snow removal equipment probably will not be made to any extent until after the local elections.

CLEVELAND

A gradual upward trend in sales of machinery and machine tools was noted in the past fortnight. A larger number of buyers were represented. Although sales are for small lots the aggregate is satisfactory. Conclusive assurance that the market is on a definite upward swing is the comparative reports of sales for September and October. The former month showed an increase over July and August while the latter month showed a decided increase over September. The only discordant note is from milling machine and turret lathe lines. This type of business is slow in materializing.

The automatic line is showing the greatest improvement. Business has increased from 25 to 40 per cent during September and October. A continuation of this condition is expected during November and the early part of December. Production has been increased to full time basis. The punch and shear business is coming in good volume. Steel fabricators being the leading buyers.

Budgeting and Research Discussed by American Management Association

Meeting in Chicago attracts many executives

OVER 350 executives registered for the fall convention of the American Management Association, which opened at the Palmer House in Chicago on Nov. 1. The meetings of the American Management Association were preceded by the first technical meeting of the Institute of Management, a research group of the American Management Association.

The speakers followed closely the outline given on the program, bringing out particularly the following points: Successful departmental budgeting assumes the existence of a budget organization whose duty it is to collect, summarize and submit for approval to the budget committee, or other body, the various departmental budgets. Departmental budgets should be taken up one at a time; it is not advisable to try to establish all departmental budgets simultaneously.

Increasing attention is being given to market research. The advisability of not setting quotas by arbitrarily increasing the previous years business a certain percentage was stressed. The value of job analysis in setting minimum and maximum salary rates was emphasized. The place of efficiency engineering incentive plans including the making of time studies, setting of standards, preparation of machine and departmental layouts, and the establishment of bonus systems was stressed in its relation to the preparation of the labor budget.

The value of a sound organization plan as a basis for successful operation of a budget system was emphasized. This point stood out in the several discussions prominently and was referred to again by later speakers in their papers.

Joseph H. Barber of the Walworth Company, prefaced his answers to the questions listed on the program by saying that an analysis of 1920 to 1926 experience shows that production costs are no greater now than they were in 1920; that 20 per cent is still gross profit and that the difficulty today is not a narrowing margin of profit as has been popularly supposed but the difficulty of reducing unit selling costs. Companies do not sufficiently consider the gross profit margin when working for additional sales. Secretary Hoover was quoted on the advisability of reducing territories and of not trying to sell the entire United States.

L. F. Musil gave a very forceful talk which was well received. He emphasized particularly the fact that one cannot consider any one budget separately; that it is important that the financial officer have confidence in the budgets prepared by the department and division heads and that it is management's job to co-ordinate the various activities of the company into a successful budget plan for the company as a whole.

It was brought out in a paper by E. L. Usner, of the Marion Steam Shovel Company, that maintenance to buildings is considered as a fixed expense and is controlled by the plant engineer. The budget is based on past experience and an analysis of requirements for the coming budget period. Improvements needed are listed in detail by the plant engineer, gone over by the general superintendent and controller of the budget. The financial program for buildings and additions is then submitted to the board of directors for their approval. Mr. Keller, of the Commonwealth Edison Company, also gave a formal discussion of this paper.

Another session was devoted to inventory budget. This was made up by an analysis of sales and production schedules. The value of standardization in reducing inventories in a steel plant was stressed by Thomas R. Jones, general manager of the Cincinnati Milling Machine Company. Sizes of steel stock were reduced from 900 to 120 by standardization. Control of the inventory budget is in the hands of the stock clerk, the purchasing agent and finally with the financial officer. The need of watching obsolete stock and the value of a budget plan in his connection was stressed.

Formal discussion of this paper was given by A. W. Bass, director of works records of the Westinghouse company. In a general discussion which followed particular interest was shown in the plan of bonuses for foremen for keeping within or below the budget.

At the luncheon meeting L. P. Alford, vice-president of the Institute, outlined the purposes of the Institute of Management, bringing out that its job is, first to act as a clearing house of information regarding research methods.

M. E. Leeds, president of the Leeds & Northrup Company, described the operation of the plan of extra compensation for executives in his company. The plan has been in operation five years. All executives participate in a common bonus fund which consists of 50 per cent of what remains after dividends or preferred stock have been paid, and a 6 per cent common stock dividend has been paid. Major executives get a larger share of bonus than minor executives, but division is not based on salary.

Management Week in Syracuse

The Technology Club of Syracuse and affiliated societies, under the auspices of the American Society of Mechanical Engineers, and in conjunction with the Manufacturers' Association, observed management week with a lecture by Col. Hugo Diemer, of LaSalle Extension University, the subject being, "Continuing Prosperity Through Better Management."

"Management is deciding what to do and then seeing that it is done," was Colonel Diemer's definition. He said that there are as many definitions as there are writers on the subject.

Other noted speakers during the week included Prof. H. W. Hepner, of the College of Business, Syracuse University; Prof. Albert Salathe, of the department of chemical engineering, Syracuse University. Dean Charles L. Raper of the college of business administration was the speaker at a meeting of the Purchasing Agents Association of central New York.

In Indianapolis

Factory executives from all parts of Indiana celebrated "Management Week" with a get-to-gether meeting at Purdue University. Executives, owners, personnel directors, employment managers and others attended.

The first day a discussion of production problems was led by E. M. Carver, general superintendent of the Dodge Manufacturing Company, of Mishawaka, and George W. Gilderman, superintendent of foundries of the same company. The program closed with an illustrated talk on the use of up-to-the-minute machine tools and their effect on production by E. B. Vancil, chief of the standards division of the Cincinnati Milling Company, of Cincinnati.

At the second day's conference, the following spoke: G. M. Williams, president of the Marmon Motor Company, Indianapolis; Lionel D. Edie, of the school of commerce and administration, University of Chicago; Fay Chandler, vice-president of the Ross Gear and Tool Company, of Lafayette; C. A. Lippincott, manager of the co-operative department of the Studebaker Corporation, South Bend; Earl Beck, personnel director of Eli Lilly & Co., Indianapolis; W. J. Heckett, industrial service department of the General Electric Company, of Fort Wayne; and J. E. Walters, director of personnel of the schools of engineering at Purdue.

L. W. Wallace, executive secretary of the American Engineering Council, Washington, made the principal address at the conference banquet.

In Rochester

The national meeting of the management division of the American Society of Mechanical Engineers convened at Rochester for the discussion of production and management problems.

Delegates to the convention and members of Rochester engineering societies joined with the Rochester Management Week Committee in a dinner at the Chamber assembly hall. "Management's Part in Maintaining Prosperity" was the subject of an address by Gano Dunn, president of the J. G. White Engineering Corporation of New York City. This meeting was arranged by the Industrial Management Council of the Chamber.

Personals

THEODORE MARBURG, president of Marburg Bros., of New York, returned last week from an extended business trip in Europe.

VICTOR ALLEN, sales manager of the Automotive Maintenance Machinery Company, of Chicago, has been appointed vice-president in charge of sales.

S. T. MASSEY, assistant general manager of the Heald Machine Company, Worcester, Mass., sailed for Europe last week. He will be gone several weeks on a business tour of the continent.

W. R. TOMLINSON, formerly vice-president of the Billings & Spencer Company, Hartford, Conn., has been appointed works manager of the J. H. William & Co.'s plant at Buffalo, N. Y.

CLAUDE DOUTHIT, president of the Indian Motorcycle Company, has been elected chairman of the board of directors, and has been succeeded as president by Louis E. Bauer.

HARRY E. MATHEWS has been appointed manager of the Charlotte, N. C., office of the Morse Chain Company. He succeeds the late George W. Pritchett. Mr. Mathews has been assistant manager of this office for the past eight years.

DR. FELIX DEUTSCH, president of the Allgemeine Elektricitats Gesellschaft, Germany, who has been making his first trip to the United States, accompanied by Dr. Emil Mayer, of the same company, sailed for home on Nov. 2.

E. B. MALLORY has been elected a director and vice-president of the Climax Engineering Company. Mr. Mallory has been associated with the Westinghouse Electric and Manufacturing Company for many years, recently as manager of the radio department.

ERNEST MUELLER, a director, and F. WARSOW, sales engineer, of the Schuchardt & Schutte Company, machine tool manufacturers, of Germany, arrived in the United States last week for a visit of one month to the company's representatives in this country.

JOSEPH WAINWRIGHT, formerly sales manager of the machinery division of Manning, Maxwell & Moore, Inc., of New York, has joined the sales organization of the Consolidated Machine Tool Corporation of America, Rochester, N. Y.

S. S. HOLMES has been appointed works manager of the Kearny, N. J., plant of the Western Electric Company. He succeeds Robert C. Dodd, who has been made assistant to the vice-president in New York. Mr. Holmes was formerly assistant works manager of the Hawthorne Works, near Chicago.

WALDO GUILD, who has been assistant chief engineer of the Heald Machine Company, of Worcester, Mass., has been promoted to chief engineer. Edward Taylor has been appointed his assistant. Mr. Quimby is chief draftsman in charge of detailing and new design. All designing work will now be done in the engineering department, while experimental and service work will be carried on under the direction of the sales service engineering department in charge of Dwight C. Page.

Business Items

The Acklin Stamping Company, of Toledo, Ohio, has opened a branch sales office in the General Motors Bldg., in Detroit. Harold Jay has been appointed district manager in charge.

The Franklin Automobile Company announces the appointment of the following: L. J. Purdy as factory manager; O. R. Miller as production manager, and R. O. Brown as plant and layout engineer.

The American La France Fire Engine Co., of Elmira, N. Y., has acquired the assets and good will of the Foamite-Childs Corporation of Utica, N. Y. The business of the two companies will be combined under the firm name of the American La France & Foamite Corporation.

The Consolidated Machine Tool Corporation of America, of Rochester, N. Y., has taken over the machine tool business of the Harrington Company, of Philadelphia. This phase of the Harrington business will be moved to Rochester where all manufacturing will be done. The Harrington plant at Philadelphia will continue to manufacture chain blocks, hoists and other material handling devices.

The Newton Die Casting Corporation is the name selected for the merger of the die casting division of the National Lead Company and the business of the Marf Machine and Die Casting Company, of Brooklyn, N. Y. For the present the two companies will continue to operate as separate units, but it is planned to locate the Newton company in a new plant at some future time. W. G. Newton, for many years president of the Marf organization, will be actively in control of the new combination.

Calendar of Local Meetings

American Society of Mechanical Engineers

Cleveland Section. Nov. 19. All-day session at Youngstown, Ohio. Subject: "Inauguration of the New Professional Division of the Iron and Steel Industry."

Boston Section. Nov. 17. Chipman Hall, evening. Subject: Motion pictures on the "Age of Speed," covering modern applications and methods of grinding.

Buffalo Section. Nov. 15. Hotel Statler, evening. Subject: Moving picture and lecture on the steel industry, by A. S. Richardson.

Detroit Section. Nov. 16. Detroit Engineering Society. Subject: "Application of Engineering Principles to the Purchase of Materials and Equipment," by Prof. C. F. Hirshfeld.

Ontario Section. Nov. 16. Brantford, Ont., evening. Subject: "Contract Law," by W. G. Hanna.

Metropolitan Section. Nov. 15. Engineering Societies Bldg., evening. Subject: "High Steam Pressure and Condensing Exhaust for Locomotives," by James M. Taggart.

Metropolitan Section. Nov. 17. Fraternity Club, evening. Subject: "An Investigation into the Recurrence of Accidents to Individuals in Industry," by Dr. Edward Elway Free.

Metropolitan Section. Nov. 22. Engineering Societies Bldg., evening. Subject: "The Oil Engine and Aeronautics," by Commander E. E. Wilson.

Philadelphia Section. Nov. 22. Engineers' Club of Philadelphia, evening. Subject: "Maintenance of Machine Tools," by J. C. Mattern.

Rock River Valley Section. Nov. 18. Nelson Hotel, evening. Subject: "Management," by Dr. Julius Klein.

Society of Automotive Engineers

Cleveland. Nov. 14. Subject: "Lacquer Surfaces—Construction, Adaptability and Use," by Dr. C. D. Holley.

Pennsylvania. Nov. 15. Subject: "Recent Developments in Connection with Engine Lubrication," by R. E. Wilson.

Detroit. Nov. 21. Subject: "Production Progress and Tire Simplification," by B. J. Lemon.

National Association of Cost Accountants

Baltimore Chapter. Nov. 15. Subject: "The Cost Accountant as an Aid to Management."

Boston Chapter. Nov. 17. Subject: "Economic Effects of Taking Business at or Below Normal Cost," by C. R. Stevenson, president of the National Association of Cost Accountants.

Buffalo Chapter. Nov. 17. Hotel Lafayette. Subject: "Operating and Financial Ratios."

Chicago Chapter. Nov. 17. Subject: "The Analysis and Distribution of Sales Promotional Costs," by James Howard Barrett, Kellogg Co., Battle Creek, Mich.

Cincinnati Chapter. Nov. 17. Subject: "Inventory Valuations," by R. Ruzicka, president, The Oakley Bank, Cincinnati.

Cleveland Chapter. Nov. 16. Plant Visitation, American Multigraph Co.

Syracuse Chapter. Nov. 15. Subject: "High Spots in the History and Development of Cost Accounting," by John A. Powelson.

Utica Chapter. Nov. 21. Subject: "Traffic Problems," by F. B. Ruder, Remington Typewriter Co.

Detroit Chapter. Nov. 17. Subject: "Inventory—Its Planning, Taking and Compiling."

Erie Chapter. Nov. 21. Subject: "Standard Costs as Applied to Jobbing Plants."

Hartford Chapter. Nov. 15. Subject: "Local Cost Methods."

Hawaii Chapter. Nov. 28. Subject: "Sugar Plantation Accounting—Practical Methods vs. Theory," by Arthur Grounds.

Indianapolis Chapter. Nov. 16. Subject: "Purchasing, Receiving and Stock Control," by Carl Sheaver, treasurer, Marmon Motor Car Co.

Kansas City Chapter. Nov. 28. Subject: "Various Phases in Factory Insurance."

Los Angeles Chapter. Nov. 22. Subject: "Use of Costs by Club Managers," by Karl Lott.

Philadelphia Chapter. Nov. 18. Subject: "Pennsylvania State Taxes," by Hon. Franklin Spencer Edmonds.

Pittsburgh Chapter. Nov. 16. Subject: "Future Developments of Cost Accounting—A Forecast," by Mervyn B. Walsh, president, Michigan Society of Certified Public Accountants.

Providence Chapter. Nov. 14. Subject: "Elements that Constitute Effective Cost Control," by L. M. Keefe.

Rochester Chapter. Nov. 16. Subject: "How I Close the Books and Furnish Statements by the Tenth of the Month," by W. L. Lewis, Bethlehem Steel Co.

St. Louis Chapter. Nov. 15. Subject: "Budgets and Budgetary Control," by Franz Eakin.

Scranton Chapter. Nov. 15. Subject: "Cost Accounting in the Coal Industry," by Geo. E. Stevenson.

Forthcoming Meetings

Automotive Equipment Association. Annual exposition, at the Colliseum, Chicago, Nov. 7 to 12.

National Founders Association. Convention, Hotel Astor, New York, N. Y., Nov. 16-17. J. M. Taylor, secretary, 22 S. La Salle St., Chicago.

American Society of Mechanical Engineers. Annual meeting, Engineering Societies Bldg., New York City, Dec. 5 to 8. C. E. Davies, assistant secretary in charge of meetings, 29 West 39th St., New York City.

National Exposition of Power and Mechanical Engineering. Sixth annual event in the Grand Central Palace, New York, Dec. 5 to 10. Charles F. Roth, manager, Grand Central Palace, New York City.

Power Transmission Association. Annual meeting, Dec. 7, Hotel Commodore, New York City. W. S. Hays, secretary, Drexel Bldg., Philadelphia.

American Association for the Advancement of Science. Second Nashville meeting, Nashville, Tenn., Dec. 26-31, general headquarters Andrew Jackson Hotel. General chairman, W. S. Leathers, M.D., professor of preventative medicine and public health, Vanderbilt Medical School, Nashville, Tennessee.

The Weekly Price Guide

Rise and Fall of the Market

IMPROVEMENT in demand, over that of a week ago, is noted in strip steel, structural shapes, rails, cast-iron and wrought-steel pipe. Pittsburgh basing discounts, on the last mentioned material, hold at levels of April 19, 1923. Smaller volume of buying is apparent this week, compared with last, in scrap, soft steel bars, sheets, and plates. No price advances occurred, comparing quotations as of Nov. 4 with those of Oct. 28, 1927. Declines affected the following materials at principal distributing points: Tin touched new low for the year in New York market; aluminum ingots, off ¾c. per lb.; galvanized steel sheets down 15c. per 100 lb. at Cleveland; solder declined 4½c. per lb., in Chicago; scrap zinc, reduced ½c. per lb. at New York and ¼c. in Chicago; linseed oil, recession of 1½c. per 7½-lb. gal., f.o.b. New York and 2c. in Chicago. Steel shapes, plates and bars (soft) are $1.75 per 100 lb., f.o.b. Pittsburgh.

(All prices as of Nov. 4)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$21.44
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.62
BIRMINGHAM	
No. 2 Foundry	17.25
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	21.26
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	22.80
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	4.50@4.75
Cleveland	5.00@5.25
Cincinnati	4.30
New York	4.75@5.25
Chicago	4.75@5.25

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.10@2.15	3.50	3.25	3.89
No. 12	2.15@2.20	3.55	3.30	3.94
No. 14	2.20@2.25	3.60	3.35	3.99
No. 16	2.30@2.35	3.70	3.45	4.09
Black				
Nos. 18 to 20	2.70	3.75	3.55	4.00
No. 22	2.85	3.90	3.70	4.15
No. 24	2.90	3.95	3.75	4.20
No. 26	3.00	4.05	3.85	4.30
No. 28	3.25	4.20	4.00	4.45
Galvanized				
No. 10	3.05	4.10	3.80	4.25
Nos. 12 to 14	3.15	4.20	3.90	4.35
No. 16	3.25	4.30	4.00	4.45
No. 18	3.40	4.45	4.15	4.60
No. 20	3.55	4.60	4.35	4.75
No. 22	3.60	4.65	4.40	4.80
No. 24	3.75	4.80	4.50	4.95
No. 26	4.00	5.05	4.75	5.20
No. 28	4.25	5.30	5.00	5.45

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft. or 100 lb.:

Thickness — Decimal	B.w.g. and Fractions	Outside Diameter in Inches — ¼	⅜	½	⅝	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	....	4.65
Spring steel, heavier	4.00	....	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	5.70	6.10
Floor plates	5.25	5.30	5.00
Cold drawn, round and hex.†	4.00	3.65	3.60
Cold drawn, flats and squares	4.50	4.15	4.10
Structural shapes	3.34	3.00	3.10
Soft steel bars	3.24	3.00	3.00
Soft steel bar shapes	3.24	3.00	3.00
Soft steel bands	3.99	3.65	3.65
Tank plates	3.34	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ¼, 7.85c.; 5/32 to ½, 7.35c. per lb. *Flat, 1/16@½-in. thick. †Shafting and screw stock.

METALS

Current Warehouse Prices in Cents Per Pound for Small Lots

Copper, electrolytic, up to carlots, New York			14.62½
Tin, pigs, 5-ton lots, New York			58.62½
Lead, pigs, up to carlots, E. St. Louis 6.02½	New York		6.87½
Zinc, slabs, up to carlots, E. St. Louis 5.75	New York		6.62½

	New York	Cleveland	Chicago
Antimony, slabs, ton spot	14.00	14.00	13.00
Copper sheets, base	22.00	22.00	22.00
Copper wire, base	18.75	18.75	15.25*
Copper bars, base	21.50	21.50	21.50
Copper tubing, base	24.00	24.00	24.00
Brass sheets, high, base	18.25	18.25	18.25
Brass tubing, high, base	23 12½	23 12½	23 12½
Brass rods, high, base	16.00	16.00	16.00
Brass wire, high, base	18.75	18.75	18.75

*Mill

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	24.37½@25	26@27	26.02
Zinc sheets (casks)	11.00	11.55	10.11
Solder (½ and ½), (case lots)	36.25	37.00	34@38

Babbitt metal, delivered, New York, cents per lb.:

Genuine, highest grade	78.00
Commercial genuine, intermediate grade	61.00
Anti-friction metal, general service	31.50
No. 4 babbitt (f.o.b.)	12.50

Nickel, f.o.b. refinery, cents per lb.:

Ingots	35.00	Electrolytic	37.00
Shot	36.00		

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	45.00
Cold drawn rods, Grade "A" (base)	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	28.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible copper	11.37½@11.62½	10.75	10.00@10.50
Copper, heavy, and wire	10.87½@11.37½	10.75	9.75@10.25
Copper, light, and bottoms	9.75 @10.00	9.25	8.75@ 9.25
Heavy lead	5.00 @ 5.37½	5.25	4.50@ 5.00
Tea lead	4.00 @ 4.25	3.75	3.50@ 4.00
Brass, heavy, yellow	7.25 @ 7.50	7.00	6.75@ 7.25
Brass, heavy, red	9.00 @ 9.25	9.50	8.75@ 9.25
Brass, light	5.25 @ 5.75	5.50	5.75@ 6.25
No. 1 yellow rod turnings	7.25 @ 7.75	7.00	6.75@ 7.25
Zinc	3.50 @ 4.00	3.25	2.50@ 3.00

TIN PLATES—Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13½	$0.16	$0.15@0.20
Cotton waste, colored, per lb.	.09@ .13	.12	.12@ .17
Wiping cloths, washed white, per lb	15½	36.00 per M	.15
Sal soda, per lb	.03¾	.02	.02¾
Roll sulphur, per lb	02⁷	.03½	.04
Linseed oil, raw, per 7½-lb. gal., 5 bbl. lots	77½	.94	.77
Lard cutting oil, 25% lard, in 5 gal. cans, per gal.	.65	.50	.50
Machine oil, medium-bodied (55 gal. metal bbl.), per gal.	.27	.35	.26
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft per inch of width for single ply.			
Medium grade	35%	35%	35%
Heavy grade	30%	30%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%*
Second grade	50–10%	60–5%	50–10%†

*Large quantities, 60%. †Large quanities, 60-10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.04
Brass rods	per lb	.16	.16	.1687½
Solder (½ and ½)	per lb.	.36¼	37	42½
Cotton waste, white	per lb.	.10@13½	10@ 13½	.13@.17½
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.10	3.10	3.10
Lard cutting oil	per gal.	.65	.65	55
Machine oil	per gal.	.27	.27	35
Belting, leather, medium	off list	35%	35%	40–5%
Machine bolts, up to 1x30 in., full kegs.	off list	50%*	50%*	40%

*New list April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
*Flint paper	$5.13	$4.95	$5.13
*Emery paper	10.71	9.15	10.71
*Emery cloth	27.84	27.85	27.84
Emery disks, 6 in. dia., No. 1, per 100:			
Paper	1.29	1.27	1.32
Cloth	3.10	3.05	3.05
Fire clay, per 100 lb. bag		.75	.75
Coke, prompt furnace, per net ton		Connellsville, 2.75@3.00	
Coke, prompt foundry, per net ton		Connellsville, 3.75@4.50	
White lead, dry or in oil,	100 lb. kegs	New York, 13.75	
Red lead, dry,	100 lb. kegs	New York, 13.75	
Red lead, in oil,	100 lb. kegs	New York, 15.25	

*4½ reams and under.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Full Kegs or Cases
Machine bolts, square heads and nuts:	
Up to ¾ x 6-in	55%
Larger up to 1 x 30-in	50%
1⅛ and 1¼ in. dia	35%
Carriage bolts:	
Up to ½ x 6-in	55%
Larger sizes	50%
Coach and lag screws:	
Up to ½ x 6-in	55%
Larger sizes	50%
Tap bolts, hexagonal heads	40%
Nuts:	
Hot pressed, square and hexagonal, blank or tapped, up to 1-in., incl	55%
Cold punched, square and hexagonal, blank or tapped, up to 1-in, incl	55%
Semi-finished, hexagonal, tapped, in packages, all sizes	40%
Case hardened, hexagonal, tapped, in packages, all sizes	30%
Washers: Deduct from list, per 100 lb.	$3.50*
Rivets, button and cone head:	
Small, including ⅞-in. dia	50–10%
Large (base) per 100 lb. net	$5.00†

Note—For less than case or keg quantities on bolts, screws, hot-pressed and cold-punched nuts, add extra of 10 per cent to list.

*$1.50 off list for broken keg lots. †$6.50 broken keg lots, net.

Machine Requirements and Industrial Construction

Equipment Wanted

Mass., Boston—W. E. Collins, 555 Huntington Ave.—¾ Stark bench lathe, No. 4.

Mich., Pontiac—Oakland Motor Car Co.—equipment for proposed 1 story, 540 x 640 ft. assembly plant. Estimated cost $2,000,000.

Que., Chicoutimi—Standard Wood Pipe Co., Ltd.—machinery and equipment for proposed plant. Estimated cost $25,000.

Opportunities for Future Business

Calif., Los Angeles—Cochise Rock Drill Mfg. Co., 273 West 115th St., awarded contract for first unit of plant, 1 story, 100 x 100 ft. on East Slauson Ave.

Calif., Los Angeles—Ensign Carburetor Co., 217 East 17th St., plans the construction of a new 100 x 200 ft. factory at Huntington Park and Alamedo and Florence Aves. Estimated cost $50,000. Architect not selected.

Calif., Los Angeles—C. H. Johnson, Commercial Exchange Bldg., will soon receive bids for a 13 story garage and office on South Broadway. Estimated cost $750,000. K. MacDonald, Jr., Spring-Arcade Bldg., Archt. Noted Aug. 4.

Colo., Denver—Labbe Mfg. Co. has acquired a site and plans the construction of a factory for the manufacture of moisture and gas appliances and lock nuts used by machinery manufacturers and railroads at Arizona Ave. and South Broadway. Estimated cost $12,000.

Conn., Norwalk—E. H. Hotchkiss Co., 6-12 Hoyt St., manufacturers of paper clips, is having plans prepared for the construction of a factory. Estimated cost $75,000. Ballinger Co., 105 South 12th St., Philadelphia, Pa., Archt.

Ill., Chicago—Hess Warming & Ventilation Co., 1207 South Western Ave., had plans prepared for a 3 story factory at 1207 South Western Ave. Estimated cost $100,000. W. H. Tomlinson, Morris Bldg., Joliet, Archt.

Ill., Chicago—G. E. Holmes, Lake St. and Wabash Ave., is having plans prepared for a 10 story, 80 x 160 ft. garage, etc. at Dearborn and West Lake Sts. Estimated cost $2,000,000. D. D. Meredith, 222 West Adams St., Archt. Noted Feb. 3.

Ill., Chicago—Interstate Iron & Steel Co., awarded contract for the construction of a 1 story, 110 x 478 ft. addition to factory at Burley Ave. and 118th St. Estimated cost $220,000.

Ill., Chicago—Youngstown Sheet & Tube Co., Youngstown, O., awarded contract for the construction of 71 by-products coke ovens and coal handling plant. Estimated cost $3,000,000.

Ill., New Athens—The Stove Works, G. Wirth, Pres. and Gen. Mgr., awarded contract for a 2 story, 144 x 265 ft. plant including foundry, assembly plant, etc. Estimated cost $100,000. Noted Oct. 13.

Ill., Rockford—Mattison Machine Works, C. L. Mattison, Supt., 545 Blackhawk Park Ave., plans a 1 story foundry. Estimated cost $50,000. Private plans.

Ill., Rock Island—Rock Island Stove Co., L. Mitchell, V. Pres., 200 Fourth St., awarded contract for a 1 story factory. Estimated cost $25,000.

Ill., Quincy—Excelsior Stove Co., W. J. Fisher, V. Pres., 510 Front St., will soon receive bids for a 1 story foundry on South Front St. Estimated cost $20,000. Behrensmeyer & Hafner, 615 West C. U. Bldg., Archts.

Ind., Evansville—City, J. C. Males, Secy., Town Hall, is having preliminary plans prepared for a 2 story, 80 x 200 ft. garage, etc., at Division and Pine Sts. Estimated cost $175,000. Architect not selected.

Ind., Evansville—F. J. Fridy, c/o F. L. Schlotter, 113½ Upper Fourth St., Archt., is having plans prepared for a 50 x 144 ft. garage and service station at Indiana Ave. and Main St. Estimated cost $46,000. Krauss Laundry Co., 130 Main St., lessee.

Ind., Fort Wayne—Truck Engineering Co., R. Spauling, Gen. Mgr., East Pontiac St., will soon award contract for a 1 story addition to factory. Estimated cost $75,000. G. Mahurin, 425 Standard Bldg., Archt.

Ind., Indianapolis—Test Realty Co., c/o Bishop-Knowlton, 312 North Meridian St., Archts., is having preliminary plans prepared for a 3 story, 100 x 165 ft. machine shop and garage at 1452-1454 North Pennsylvania St. Estimated cost $92,000.

Ind., Indianapolis—Western Oil Co., 310 North Meridan St., awarded contract for a 76 x 120 ft. garage at 2802 East New York St. Estimated cost $40,000. Bishop, Knowlton & Carson, 312 North Meridian St., Archts. and Engrs.

Ind., Indianapolis—I. Wolf, 555 North Capitol St., awarded contract for a 49 x 128 ft. machine shop at 722 North Capitol St. Estimated cost $40,000.

Ind., Lafayette—J. F. Horner, awarded contract for a 70 x 112 ft. garage and repair shop. Estimated cost $43,000.

Iowa—Maintenance Superintendent, Algona, will receive bids until Nov. 10 for the construction of two garages, 1 story, 26 x 96 ft. each at Algona and Emmetsburg. Also will soon award contract for two garages, 26 x 48 ft. each, at Estherville and one at Spirit Lake.

Ia., Cresco—A. Brown, Maintenance Supt., Cresco, will receive bids until Nov. 18 for the construction of a 1 story, 40 x 50 ft. garage at Davis Corners.

Ia., Des Moines—E. W. Brown awarded contract for a 3 story, 160 x 200 ft. garage. Estimated cost $250,000.

Ia., Storm Lake—Maintenance Superintendent will soon award contract for the construction of a 26 x 96 ft. garage.

Ky., Louisville—Bd. of Education, plans the construction of a 4 story school including shops, etc. at 40th and Herman Sts. Estimated cost $800,000. J. Meyrick Cooley, c/o Bd. of Education, Archt.

Md., Baltimore—Davidson Storage & Transfer Co., I. W. Davidson, Eutaw and Lombard Sts., will soon receive bids for a 1 story garage at Elgin and Pennsylvania Aves. Estimated cost $60,000. S. Russell, 11 East Lexington St., Archt.

Mass., Boston—J. H. Broderick, 101 Tremont St., will build a 3 story garage and repair shop at 176-194 Ipswich St. G. E. Robinson, 80 Federal St., Archt. Noted Oct. 20.

Mass., Brighton—(Boston P. O.)—Argonaut Realty Corp., H. C. Hickey, General Motors Bldg., Detroit, Mich., awarded contract for a 2 story repair and service garage at North Beacon St. here.

Mass., Brookline (Boston P. O.)—Cadillac Motor Car Co., 2860 Clark St., Detroit, Mich., awarded contract for a 2 story, 180 x 245 ft. repair and service garage at Commonwealth Ave. and Essex St. Noted Oct. 20.

Mass., Cambridge (Boston P. O.)—Holland System, Inc., D. J. Holland, 27 Haymarket Sq., Boston, awarded contract for the construction of a 3 story factory at 31-45 Main St. here. Estimated cost $40,000.

Mass., Everett (Boston P. O.)—Melanson Bros. Inc., 67 Chelsea St., is receiving bids for a 1 story, 75 x 110 ft. addition to shop. Estimated cost $40,000. Private plans.

Mass., Hudson—Clark's Chevrolet Co., Main St., awarded contract for a 1 story repair and service garage at Lower Main St. Estimated cost $40,000. E. T. Chapin, 340 Main St., Worcester, Archt.

Mich., Pontiac—Oakland Motor Car Co., awarded contract for a 1 story, 540 x 640 ft. factory on Oakland Ave. Estimated cost $2,000,000.

Mo., Bridgeton—A. B. Lambert, 457 North Kingshighway Blvd., St. Louis, plans an election soon to vote $1,200,000 bonds for the construction of an airport including machine shops, etc. here.

Mo., St. Louis—C. G. Kruckemeyer Machine & Parts Co., 1365 Cockrill Ave., awarded contract for a 1 story factory at Minerva Ave. and Hodiamont Ry. Estimated cost $50,000.

N. J., Hackensack—Owner, c/o J. L. T. Tillack, 173 Main St., is having sketches made for a 5 story garage. Estimated cost $200,000.

N. J., Newark—L. A. Myers, Jr., Inc., 139 Ogden St., manufacturers of metal products, awarded contract for a 2 story, 78 x 90 ft. factory. Estimated cost $40,000. Noted Nov. 3.

N. J., Ocean City—C. Cerns, c/o O. F. Zurn Oil Co., Broad St. and Leigh Ave., plans to rebuild garage recently destroyed by fire at 9th St. and Atlantic Ave. Estimated cost $75,000.

N. Y., Brooklyn—L. Mininsohn & J. Sussi, 1048 39th St., had plans prepared for a 2 story garage at Ashland and Johnson Sts. Estimated cost $75,000. Bennett & Koeppel, 7826 5th Ave., Archts.

N. Y., Buffalo—Packard Motor Car Co., 1325 Main St., plans a 1 story addition to repair and service garage. Estimated cost $75,000.

N. Y., New York—Bd. of Transportation, awarded contract for a car for a car shop and maintenance plant including machine, woodworking, forge and backsmith shops, etc. for new subway system at 207th St. Estimated cost $4,170,000. Noted Aug. 25.

N. Y., New York—Pelham Bay Garage Co. Inc., c/o W. Shary, 41 Union Sq., plans a 2 story, 103 x 168 ft. repair and service garage. Estimated cost including equipment $100,000.

N. Y., Prattsville—Bd. of Water Supply, G. J. Gillespie, Pres., will receive bids until Nov. 22 for the construction of a maintenance building including 22 x 72 ft. garage and shop, etc.

O., Cincinnati—G. A. Schacht Motor Truck Co., W. Schacht, Pres., 8th and Evans Sts., plans a 1 story addition to factory. Zittel & Rapp, 1206 Mercantile Library Bldg., Archts.

Okla., Tulsa—W. O. Morrow, K. C. Connens, plans a 100 x 140 ft. addition to garage on Cincinnati St. Estimated cost $75,000. Concrete Engineering Co., Walsix Bldg., Kansas City, Mo., Engr.

Pa., Sharon—Sharon Pattern Works, E. Collins, Mgr., 96 Chestnut Ave., plans the construction of a 2 story pattern shop. Clepper & Clepper, McDowell National Bank Bldg., Archts.

R. I., Providence—J. Conn, awarded contract for the construction of a garage. Estimated cost $150,000. Noted Nov. 3.

Tex., Mount Pleasant—G. C. Ehemann Co., Bank of Commerce Bldg., Memphis, Tenn., will build a hardwood mill here. Estimated cost $45,000. Private plans.

Va., Norfolk—Royal Silver Mfg. Co., Bellentine Pl., awarded contract for converting store building into garage at Main and Randolph Sts.

Wis., Kaukauna—Moloch Co., c/o R. M. Kanik, is having plans prepared for a 1 story machine shop. Estimated cost $50,000.

Ont., Toronto—A. D. Garrie & Co., 354 Victoria St., is having plans prepared for a 3 story, 150 x 150 ft. garage. Estimated cost $175,000. M. Brown, Confederation Life Bldg., Archt.

Que., Montreal—Canadian Vickers Ltd., plans extensions and improvements to aircraft factory.

Que., Montreal—S. W. Reed & Co., 37th St. Antonine St., awarded contract for 1 story, 76 x 146 ft. factory for the manufacture of fireproof windows and doors, metal stampings, etc. Estimated cost $35,000.